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Systematic and Zoogeographic Studies on the Reptilian Trematode Fauna of Tabasco, Mexico.

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SYSTEMATIC AND ZOOGEOGRAPHIC STUDIES ON THE REPTILIAN TREMATODE FAUNA OF TABASCO, MEXICO

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ABSTRACT

Trematodes of reptiles from central Tabasco, Mexico, were studied in order to ascertain which species occur in that state, and to compare these with similar faunas in the United States and South America. A total of 475 reptile hosts of 39 species were examined. These included 8 species of lizards, 23 species of snakes, 1 species of crocodile, and 7 species of turtles.

In all, 29 species of trematodes, in 11 families, were recovered and studied. Dadaytrema sphaerorchidum n. sp. (Paramphistomidae) from Dermatemys mawii, Parahaplometroides basiliscae n. gen. and n. sp. (Plagiorchiidae) from Basiliscus vittatus, Opisthogonimus tabascensis n. sp. (Plagiorchiidae) from Coniophanes quinquevittatus, Acanthostomum megacetabulum n. sp. (Acanthostomidae) from Drymarchon corais melanurus, and Proterodiplostomum ophidum n. sp. (Proterodiplostomidae) from Drymarchon corais melanurus are described. Also, Catadiscus marinholutzi Freitas and Lent, 1939, and Parallopharynx arctus, Caballero, 1946, are redescribed, and the generic diagnosis of the latter is emended.

For the previously known trematodes, 28 new locality records and 56 new host records are presented. Tabasco is reported to be a region of overlap between nearctic and neotropical reptilian trematode faunas. On the basis of known trematode distribution, Tabasco is regarded as having a reptilian trematode fauna that is 43 percent Central American, 36 percent South American, and 21 percent North American in origin.

INTRODUCTION

Tabasco is one of the southernmost states of Mexico, and it is bordered by the states of Veracruz, Chiapas, and Campeche. To the east and southeast it has a common boundary with the Republic of Guatemala. Tabasco forms a part of what has been called "the Gulf Lowlands of Southern Mexico." Much of the state is periodically inundated, and only a few places exceed thirty feet in elevation.

The climate of Tabasco is tropical with two seasons of heavy rainfall per year. There are large areas in the state covered by tropical rain forests, and there are many permanent swamps and flooded cane thickets. There are also some expanses of open agricultural land and savannas.

The zoology of Tabasco is less well known than that of many other Mexican states owing in part to its former inaccessibility to automobile travel. Although a paved highway now joins Tabasco and the neighboring state of Veracruz, travel by automobile within the state is still difficult. Other than the entrance highway, the only other paved road of any significance is the one that extends approximately thirty miles between the capital city of Villahermosa and the town of Teapa. The few unpaved roads in the state tend to become impassable to vehicular travel during periods of heavy rainfall. Much of the local travel and transport is accomplished by the use of power boats and dug-out cayucos operating on the numerous rivers.

The present study of the trematode fauna of reptiles in Tabasco was undertaken with two major objectives in mind. In the first place, the trematode fauna of the area was little known, and, hence, it was thought that new information would come to light. The second reason for selecting Tabasco for this study was to test the validity of the published opinion of Dr. Eduardo Caballero y C., of the Universidad Nacional Autonoma de Mexico, to the effect that southeastern Mexico represents a region of overlap between nearctic and neotropical trematode faunas. A special section of the present paper is devoted to an analysis of the new information in the light of this contention.

The difficulties of travel made it highly impracticable to make collections of repitle hosts from all parts of the state. Instead, a small centrally located region was selected for more intensive collecting. In view of the similarity in topography and climate throughout much of the state, it was thought that this method would yield results in most respects comparable to those that might be obtained by a more extensive survey. The results obtained tend to bear out this assumption in that many of the species encountered have also been reported from Brazil. From this fact, it seems probable that a sample taken anywhere in Tabasco would include these wide-ranging forms. Limiting the area of collections may possibly have resulted in missing a few species that have a local or spotty distribution. This difficulty may be offset in part, however, by the advantage a limited area offers in enabling one to encounter forms that have a seasonal fluctuation.

The collection site for the present study was an area of about six miles in diameter on the Teapa river. This area was partially situated on a large ranch known as El Colorado, which is approximately

15 miles north of the town of Teapa. A base of operations was established at the finca of Mr. Carlos Cardenas y Perez on the east bank of the river. This location provided easy access to forest and swampy areas as well as to the open savannas of which much of El Colorado is composed. Most of the reptile hosts used in the present study were obtained within this area, but a few specimens were also taken in the vicinity of Teapa. Several hosts were also collected between the towns of Teapa and Tacotalpa.

A total of nearly nine months was spent in the field in the course of this study. This period included the months of June through August, 1958, and January through July, 1959. During this time, 475 reptile hosts of 39 species were examined. From these hosts, 29 species of trematode parasites were recovered. As far as could be determined, only one of these species has previously been reported from Tabasco. Five trematode species are herein described for the first time, and one of the new species is believed to represent a new genus, which is also characterized. Also, many new host records are reported for the previously known parasites. Additionally, studies of large series of trematodes of the same species have revealed some interesting new features in comparative morphology and phenomena of intraspecific variation.

MATERIALS AND METHODS

Collection of hosts: The majority of hosts used in this study were purchased from rural natives in Tabasco. Because of the dense flora of the region, many reptile species could not have been acquired any other way. Groups of natives with machetes engaged in clearing over-grown areas would often encounter reptiles that an individual collector might never chance upon. All specimens purchased from natives were either alive or so recently killed that they still displayed muscular activity. No specimen was accepted that did not show such evidence of being fresh.

The crocodiles, Crocodylus moreletii, used in this study could only be obtained occasionally. Whenever the river reached flood stage, it filled low adjacent swampy areas, which enabled crocodile hunters to search for the animals by means of dug-out canoes. Conversely, when the river reached a very low level and the water became clear, it was possible to obtain specimens of the large river turtle, Dermatemys mawii. These turtles are much sought after as items of diet and are speared from dug-outs. Most other reptiles could be found at any time of the year, but on a chance encounter basis.

Several kinds of reptile could be more easily obtained by personal collecting. The methods employed varied in accordance with the size and habits of a particular species. Small snakes and lizards were mostly hand caught, and they were kept alive in cloth bags until time for

examination became available. Species that were either too fast or too large to capture by hand were necessarily shot. Dust shot and lead bullets fired from a 22 calibre pistol were used for this purpose. In the case of the large and venomous Fer d' lance, Bothrops atrox, a specially devised cable noose was employed to capture living specimens.

Examination of hosts: All specimens were anesthetized with ethyl ether prior to posting. Ether had previously been determined to be the best anesthetic for this purpose. Properly anesthetized specimens come out of the killing jar without the contraction and distortion which may be introduced if chloroform or other reagents are used.

Upon removal from the killing jar, each reptile was measured, and these measurements were recorded. The measurements taken were the overall length and the snout to vent length. After measurements had been taken, each specimen was eviscerated and the various organs were inspected for the presence of trematode parasites. A dissecting microscope was employed to aid in this examination. Special attention was given to sites known to be habitable to trematodes. These included the digestive tract, the lungs, the liver and its associated gall bladder and common bile duct, the ureters and urinary bladder, and the heart and larger blood vessels. After each organ had been examined and visible trematodes removed, it was placed in a finger bowl of water and washed thoroughly. The contents of the bowl were then inspected microscopically to ascertain if any trematodes had been missed in the first examination. The post mortem examination of turtles presented certain special problems. For example, the plastron had to be removed before evisceration could proceed. To accomplish this a small bone saw was

used to sever the plates that join the plastron to the carapace.

Determination of hosts: In order to assure the most accurate determination of hosts possible, a representative collection of from one to several specimens of each species was retained. These specimens were fixed and preserved in a 10% formalin solution, and they have been deposited in the herpetological collection of the Louisiana State University, Museum of Natural History. The material was sent from the museum to two of the leading specialists in the field of herpetology for determination. The 1958 collection was identified by Dr. Edward Taylor of the University of Kansas, while the 1959 material was determined by Dr. Hobart Smith of the University of Illinois.

Field preparation of trematodes: As soon as trematodes were encountered, they were placed in Stender dishes of water and examined under the microscope. Any visible morphological detail, which was deemed worthy of note, was duly recorded. For example, the extent of the excretory bladder can sometimes be seen to best advantage in living specimens. The trematodes were then killed with gentle heat, which has been found to produce the least amount of distortion of any killing method. Very small forms were placed on a microscope slide, covered with a cover glass, and a lighted match was carefully passed beneath the slide to kill the worms. Large trematodes were killed in a dish by placing it in the sunlight or near a heat source.

All specimens were fixed on slides. The fixative solution was drawn beneath the cover glass with the aid of a strip of filter paper. A solution commonly known as APA was used to fix trematodes. This solution was composed of 85 parts of 85% ethyl alcohol, 10 parts of 40% formaldehyde, and 5 parts of glacial acetic acid. The theft of

the supply of glacial acetic acid in 1958 necessitated use of this mixture without the addition of the latter reagent. Therefore, trematodes collected during 1958 were fixed in a solution containing only alcohol and formaldehyde. It was found that this solution worked equally well except that more time was required to allow for the slower penetration of the fluid into the tissues.

After the worms had been in the fixative solution for a few minutes, they were removed from the slide and stored in vials containing the same solution. Each vial was inscribed with the field collection number of the host from which the worms had been obtained. The date of the collection was also written on the vial, and a diamond pointed laboratory glass pencil was used for this purpose. After the worms had been in the fixative solution for several days, they were transferred to 80% alcohol for preservation.

Laboratory preparation of trematodes: Whole mount slides were prepared using Mayer's carmalum stain with a 35% acid-alcohol destaining solution. A graded series of alcohol was used for gradual dehydration, and clearing was accomplished in methyl salicylate. Specimens were mounted in Canada balsam dissolved in xylol.

In the case of certain genera of trematodes where hundreds of specimens were involved (Infidum, Ochetosoma, Telorchis, etc.), a special technique had to be devised in order to be able to study them adequately. The same stain and reagents were used, but the specimens were group stained. They were then returned to their marked vial, a piece of gauze was tied over the mouth of the vial, and then the entire group was run through the alcohol series and into the clearing agent still in the original vial. It has thereby been

possible to study large numbers of some species comparatively by placing the specimens in small dishes, or on depression slides, and examining them under the microscope.

Serial sections were prepared of all species believed to be new and of other species when structural relationships could not be ascertained from whole material. Specimens were embedded in a mixture containing four parts of parawax to one part of beeswax for sectioning. It was found that the addition of the beeswax permitted the cutting of a ribbon that was less likely to break. Sections were cut at 10 microns and affixed to he slides with Mayer's albumin mixture. The sections were stained by using a standard Delafield's haematoxyln - acid eosin - xylol technique.

In the case of species that are herein being described as new, the holotype and one paratype will be deposited in the Helminthological Collection of the United States National Museum. Additional paratypes will be deposited in the collections of the Instituto de Biologia of the Universidad Nacional Autonoma of Mexico, the Department of Zoology of Louisiana State University, and the author's personal collection.

SYSTEMATIC SECTION

Introduction: The most important monographic works on the subclass Digenea are those of Dubois (1938 and 1953), Dawes (1946), Skriabin (1947-1960), and Yamaguti (1953 and 1958). The most comprehensive work on the subclass Monogenea is that of Sproston (1946).

There is widespread agreement among invertebrate zoologists that the Monogenea are less highly specialized than are the Digenea. The Monogenea are therefore treated first in the present study, and Sproston's system of classification is followed.

The phylogenetic relationships of the families and genera of Digenea have not been completely elucidated. There is considerable disagreement among the above-mentioned authors as to the placement of the higher taxonomic categories. Since such considerations fall beyond the scope of the present study, the most recent system (Yamaguti, 1958) has been followed with regard to the recognition of family and subfamily names. The sequence used by Skriabin in his extensive monograph is largely alphabetical rather than phylogenetic. The latter method is used in the present work when no obvious phylogenetic sequence can be perceived.

Among the Digenea there is some evidence to support the contention that the Paramphistomidae represent one of the most primitive families. This family is, therefore, placed first under the Digenea. There can be little doubt that the Proterodiplostomidae and the Heronimidae are

among the most highly specialized of the Digenea. Consequently, these groups are treated last in the systematic section. The other families have been arranged between the Paramphistomidae and the Heronimidae in what is hoped may approximate a natural phylogenetic sequence.

The comparative morphology of the families and genera concerned has been the basis for the selection of this supposed phylogenetic sequence. The site of the parasite within the host has also been taken into consideration, and it is believed to be useful in this regard. It is thought that a higher degree of specialization is indicated by sites like the gall bladder and ureter than by sites such as the mouth and cloaca. For example, the Monogenea are usually not found in sites that represent deep penetration within the body of the host. The Monogenea that are found in reptiles are most often encountered in the mouth, cloaca, or urinary bladder. The Paramphistomidae, which are regarded as structurally primitive among the Digenea, are often found in similar sites near the surface of the body. The Dicrocoeliidae, on the other hand, represent a group that has penetrated more deeply into the host. Many representatives of the latter family inhabit the gall bladder or the common bile duct. Families such as Brachycoeliidae, Proterodiplostomidae, and Acanthostomidae are often found in the upper portion of the intestinal tract.

Phylum Platyhelminthes Gegenbaur, 1859

Class Trematoda Rudolphi, 1898

Subclass Monogenea Carus, 1863

Superfamily Polystomatoidea Price, 1936

Family Polystomatidae Gamble, 1896

Subfamily Polystomatinae Price, 1936

Neopolystoma domitilae (Caballero, 1938)

Hosts: *Pseudemys scripta ornata*

Chelydra serpentina

Site: urinary bladder and cloaca

Geographic range: Veracruz and Tabasco

Two specimens of this parasite were collected from *Pseudemys scripta ornata*, and a single specimen came from *Chelydra serpentina*. The latter apparently constitutes a new host record for the species. Sproston (1946) recognized *N. domitilae* as a valid species even though it is closely similar to *N. orbiculare* Stunkard, 1916. Sproston separates these two forms on the basis of the number of hooklets present in the genital coronet. *N. domitilae* is said to have from 19 to 20 such hooklets, and *N. orbiculare* has 16. The three specimens in the present collection have 19, 20, and 21 hooklets respectively. Therefore, these specimens are assigned to Caballero's species. In addition to listing a new host, the present report constitutes the first record for the species in the state of Tabasco.

Polystomoides coronatus (Leidy, 1888)

Hosts: *Pseudemys scripta ornata*

Chelydra serpentina

Clemmys marmorata

Graptemys geographica

Trionyx ferox

Trionyx spinifera

Site: mouth, sometimes nostrils

Geographic range: Massachusetts, Iowa, North Carolina, Oregon, Texas, and Tabasco

A single specimen, apparently belonging to this species, was collected from the oral cavity of *Pseudemys scripta ornata* in Tabasco. The specimen, although somewhat smaller than typical mature individuals of the species, shows the characteristic haptoral anchors. It also has 36 hooklets in the genital coronet, which falls within the range for the species. For these reasons the present specimen is assigned to this nearctic species.

This species has previously been recorded from *Pseudemys scripta* in the United States, but no report of it from Mexico has been encountered. Hughes, Higginbotham, and Clary (1941) listed the first six of the above-mentioned hosts, and Thatcher (1954) recorded *Clemmys marmorata* as a host in Oregon. *P. coronatus* may be regarded as a truly nearctic species since no records of it for South America exist.

Subclass Digenea Carus, 1863

Family Paramphistomidae Fischoeder, 1901

Subfamily Dadaytrematinae Yamaguti, 1958

.Dadaytrema sphaerorchidum n. sp.

Host: Dermatemys mawii

Site: upper large intestine and lower small intestine

Geographic range: Tabasco

Illustration: Plate II

Both specimens of Dermatemys mawii that were examined in Tabasco were found to contain large numbers of amphistomes that appear to represent a heretofore undescribed species of Dadaytrema. About 500 of these worms were recovered. These parasites could readily be distinguished from the two species of Schizamphistomoides with which they occurred in mixed infection. The presently considered form is only about half as large as the species of Schizamphistomoides, and the testes are in tandem.

Travassos, 1931, created the genus Dadaytrema to include Amphistoma oxycephalum Diesing, 1836, and Chiorchis papillatus Daday, 1907. He regarded these names as synonyms. Subsequently, Vaz, 1932, described two additional species in the genus. All three of these species have only been reported in Brazilian fishes.

The genus Dadaytrema has an oral sucker with diverticula and circumoral ridges and papillae. The testes are tandem in the pre-equatorial region. A cirrus pouch is present. The ovary is located well posteriorly, and the vitellaria are situated in the region of the posterior portions of the caeca, which extend to near the posterior sucker.

All of the specimens in the present collection have been stained, cleared, and comparatively studied. A selected group of 35 individuals has been whole mounted, and two worms have been serially sectioned. Measurements in the description are of the holotype followed by the ranges in parentheses. The size ranges were obtained by selecting and measuring the smallest and largest mature specimens in the collection. All measurements are in millimeters. It should be noted that all of these worms were moderately contracted. The same individuals in a living state would be able to extend to nearly twice the indicated length.

Description: Dadaytrema sphaerorchidum has the characteristics of the genus. The body is muscular and robust with a thick, non-spinous cuticle. It is slightly flattened dorso-ventrally and tapers towards both extremities. The body measures 9.25 (3.28-9.75) in total length, and it is 2.5 (1.31-2.58) in width at the level of the posterior testis.

The oral sucker is barrel-shaped with a terminal aperture. It is 0.70 (0.51-0.70) in length by 0.38 (0.356-0.445) in width. Surrounding the oral aperture are cuticular rugae, which become more or less apparent depending on the state of contraction or extension of the anterior end. Two oral diverticula extend posteriorly from the posterior end of the oral sucker. The diverticula measure about 0.24 (0.152-0.28) in length by 0.14 (0.082-0.142) in width. An oesophagus extends from the oral sucker to the oesophageal bulb. The oesophageal bulb measures 0.317 (0.165-0.365) in diameter. The intestinal caeca do not quite reach the acetabulum. The posterior

tips of the caeca are often directed medially. The acetabulum is ventro-terminal, and it measures 1.1 (0.71-2.2) in length by 1.05 (0.610-1.14) in width.

The testes are tandem and situated immediately pre-equatorially. They are spherical masses that sometimes show weak lobation. The anterior testis is 1.08 (0.57-1.14) long by 1.01 (0.70-1.21) wide. The posterior testis measures 0.98 (0.57-1.05) long by 1.04 (0.70-1.14) wide. The cirrus sac measures 0.332 (0.252-0.495) long by 0.165 (0.102-0.239) wide. It contains an unarmed cirrus and scattered prostatic cells. The position of the genital pore varies from the level of the intestinal bifurcation to slightly posterior thereto depending on the state of contraction of the worm. There is no genital sucker.

The small, spherical ovary is located in the posterior region of the body at about the level of the termination of the caeca. The ovary measures 0.29 (0.165-0.30) in diameter. The distance from the posterior border of the ovary to the anterior margin of the acetabulum is 0.86 (0.228-0.89). A Laurer's canal extends from the ootype to the dorsal surface of the body. The uterus makes one or two coils posterior to the ovary, and then it proceeds anteriorly to fill the inter-caecal area between the ovary and the testes. The vitelline system is composed of from 30 to 50 roughly spherical follicles, which are situated on each side of the body dorso-lateral to the intestinal caeca. These follicles extend from a slightly post-equatorial region to the ends of the caeca. Individual follicles measure from 0.089 to 0.19 in diameter. The eggs are numerous, large, thin-shelled, and operculate. The eggs

measure 0.074-0.076 in width by 0.133-0.165 in length. The eggs in the terminal portions of the uterus contain well-developed embryos.

The ovoid excretory bladder is situated between the ovary and the acetabulum. It communicates with the outside via a short duct to the excretory pore, which is situated on the dorsal surface. Two main excretory ducts course anteriorly from the bladder. These are lateral and dorso-lateral to the caeca.

The lymphatic system is similar to that of other amphistomes. Three main lymphatic channels run longitudinally on each side of the body in close association with the caecum. These channels empty into sinuses in the vicinity of the oral sucker and the acetabulum. The lymphatic channels that run dorsal to the caeca are considerably larger than the others. In some specimens these dorsal channels have expanded ovoid portions posterior to the ends of the caeca. They thus have the position and appearance of the "cuerpecitos" of Caballero, which are discussed in relation to Schizamphistomoides resupinatum.

Discussion. The three previously described species in the genus were taken from fish hosts in Brazil. The present report is believed to be the first record of a species of Dadaytrema in a chelonian host, as well as the first record of the genus for Mexico.

D. sphaerorchidum differs from the other described species in having testes that are nearly spherical. The other species have testes that are highly lobate. Of the three species, D. oxycephalum is the most nearly similar to D. sphaerorchidum in size and appearance. As can be seen from the table of dimensional comparisons,

D. sphaerorchidum has a relatively larger acetabulum than does *D. oxycephalum*. Also, the eggs of the new species are larger than those of *D. oxycephalum*.

Table I Dimensional Comparisons of *Dadaytrema sphaerorchidum* and *Dadaytrema oxycephalum*

		D. sphaerorchidum	*D. oxycephalum*
body:	length	3.28-9.75	2.2-9.5
	width	1.31-2.58	0.7-3.5
oral sucker:	length	0.51-0.70	0.4-1.0
	width	0.356-0.445	0.3-0.4
oral diverticula:	length	0.152-0.280	0.15-0.3
	width	0.082-0.142	0.1-0.13
oesophagus:	length	0.127-0.730	0.8-1.1
bulb:	diameter	0.165-0.365	0.15-0.17
acetabulum:	diameter	0.610-2.20	0.72-1.2
anterior testis:	length	0.570-1.14	1-1.14 (dia-
	width	0.70-1.21	meter of central
			mass)
posterior testis:	length	0.570-1.05	(have ramifica-
	width	0.70-1.14	tions extending
			0.1-0.4)
cirrus sac:	length	0.252-0.495	0.3-0.8
	width	0.102-0.239	0.1-0.5
ovary:	diameter	0.165-0.30	0.26-0.4
ovary to acetabulum:		0.228-0.89	0.06-0.12
vitellaria:	diameter	0.089-0.19	not given
egg:		0.074-0.076 x 0.133-0.165	0.05-0.07 x 0.07-0.13

Subfamily Dermatemytrematinae Yamaguti, 1958

Dermatemytrema trifoliatum Price, 1937

Host: *Dermatemys mawii*

Site: lower intestinal tract

Geographic range: Mexico

Price, 1937, described this form from the same host species taken in Mexico. He did not identify the state from which the material came. In the present study, a single specimen has been found that is undoubtedly conspecific with Price's material. This specimen was found in a mixed infection with hundreds of other amphistomes and angiodictyids. The specimen is about 2 mm. in length, and it has the general proportions of Price's species. The acetabulum is large, and it has a trifoliate aperture, which was the basis for the specific name. It is not presently possible to add any significant morphological detail to the original description on the basis of a single specimen.

Subfamily Diplodiscinae Cohn, 1904

Catadiscus marinholutzi Freitas and Lent, 1939

Hosts (Tabasco):

Coniophanes bipunctatus biseriatus

Coniophanes imperialis clavatus

Coniophanes quinquevittatus

Leptodeira septentrionalis polysticta

Thamnophis sauritus chalceus

Hosts (Brazil):

Leptodactylus ocellatus

Leptodactylus caliginosus

Site: upper intestinal tract

Geographic range: Brazil to Tabasco

Illustration: Plate I

Freitas and Lent, 1939, described C. marinholutzi from the two frog hosts from the state of Mato Grosso in Brazil. All of the hosts of this species encountered in the present study were small snakes that normally feed on frogs. Frogs of the genus Leptodactylus are known to occur in Tabasco, and it is probable that these are the normal definitive hosts. Some 57 specimens of C. marinholutzi were recovered from 14 infected snakes. The largest single infection numbered 13 individuals. Although this form appeared to be established and producing eggs in the snake hosts, it is presumed that the snakes represent accidental hosts of the species.

In order to identify this species, 56 specimens were stained, cleared, and studied. One individual was serially sectioned and studied. It has been found that the original description of the species is not only brief, but it is difficult to obtain. For these reasons, a description of the form is included herein. The size ranges were obtained by measuring the smallest and largest mature specimens in the series. All measurements are in millimeters.

Description: Catadiscus marinholutzi has the characteristics of the genus. The body is pyriform in shape tapering sharply from the large posterior sucker to the small oral sucker. The cuticle is unarmed and average 0.0035 in thickness. The body measures 0.93-2.52 in length by 0.49-0.83 in width.

The oral sucker measures 0.076-0.114 long by 0.102-0.127 wide.

The relatively large oral diverticula are 0.076-0.129 long by 0.063-0.101 wide. The oesophagus has a bulb at its posterior end. The bulb is 0.089-0.129 long by 0.076-0.101 wide. The caeca are short, and they extend posteriorly almost to the equatorial region, or a distance of 0.445-1.07 from the anterior extremity. The large posterior sucker is 0.32-0.71 long by 0.33-0.61 wide.

A single, large testis is centrally situated in the body. It is rather variable in shape, but it is most often wider than long. The testis measures 0.178-0.448 long by 0.216-0.368 wide. A single vas deferens leads from the testis to the small, oval hermaphroditic bursa. Both internal and external portions of the seminal vesicle are present, and the bursa contains a few scattered prostatic cells. The genital pore is at the level of the posterior end of the oesophageal bulb.

The small ovary is situated to the right of the median line and posterior to the testis. It is quite variable in shape. The ovary measures 0.070-0.170 long by 0.070-0.134 wide. The ootype and Mehlis' gland are situated just posterior to the ovary. A short Laurer's canal is present. There is no seminal receptable. The vitelline system consists of from 20 to 35 large, spherical follicles, which measure 0.055-0.063 in diameter. These follicles are variable in both number and distribution. They are most often situated dorso-laterally in the region posterior to the intestinal caeca. Quite often these follicles cross the body forming a band posterior to the caeca but anterior to the testis.

The eggs are large and thin-shelled, and they taper towards the operculate end. The eggs measure 0.064-0.0775 X 0.114-0.152. Specimens

in the present series show from 1 to more than 150 eggs in the uterus.

The small excretory bladder is located medially near the anterior margin of the posterior sucker. A prominent excretory canal courses anteriorly on each side of the body reaching the vicinity of the oral diverticula.

The lymphatic system seems to be similar to that of other amphistomes as reported by Willey (1930). There are 6 main lymphatic channels running longitudinally in the body, a dorsal, a ventral and a lateral channel on either side. These are in close association with the intestinal caeca. In the anterior region, near the oesophagus and oral diverticula, the lymphatic channels broaden to form sinus-like expansions. Cross sections through this region show the entire area between the body wall and the oesophagus to be filled with lymphatic structures.

There can be little doubt that the present specimens from Tabasco are conspecific with C. marinholutzi from Brazil. This species differs strikingly from the other 8 species in the genus by the size and distribution of the vitelline follicles. It can be seen from the following table that the size ranges of the present series overlap the published measurements of Freitas and Lent. The present report is believed to be the first record of the species outside of Brazil, and, hence, it is a considerable range extension. Also, 5 ophidian hosts of the species are herein reported for the first time.

Table II Dimensional Comparisons of Samples of *Catadiscus marinholutzi*

		Tabasco	Brazil*
body:	length	0.93-2.52	1.61-2.49
	width	0.49-0.83	1.05-1.29
oral sucker:	length	0.08-0.114	0.08-0.10
	width	0.102-0.127	0.18-0.22
oesophageal bulb:	length	0.089-0.127	0.15-0.18
	width	0.063-0.101	0.06-0.10
acetabulum:	length	0.32-0.71	0.70-0.90
	width	0.33-0.61	0.53-0.98
testis:	length	0.178-0.240	0.28-0.53
	width	0.216-0.368	0.33-0.55
ovary:	length	0.070-0.170	0.10-0.17
	width	0.070-0.144	0.12-0.15
egg:	length	0.144-0.152	0.113-0.126
	width	0.064-0.0775	0.059-0.071

*After Freitas and Lent, 1939.

Subfamily Schizamphistominae Looss, 1912

Schizamphistomoides resupinatum Caballero, 1940

Host: *Dermatemys mawii*

Site: large intestine

Geographic range: Veracruz and Tabasco

Both of the specimens of *Dermatemys mawii*, examined in the present study, were found to contain numerous examples of *S. resupinatum*. Present material closely compares to Caballero's description. He described the species from the same host species taken at Alvarado, Veracruz. Caballero reported a rather unique morphological structure in this species. He stated that a short distance ahead of the posterior sucker, on either side of the body, a small spherical body could be observed in both living and fixed specimens. He termed these structures "cuerpecitos", but did not speculate on their nature or function. Since these structures could readily be seen in the present series, an attempt was made to determine their nature. For this purpose, serial sections were made through the posterior regions of several specimens. A study of the sections revealed that the cuerpecitos are relatively heavy-walled portions of the lymphatic system filled with lymphatic fluid and scattered amoebocytic corpuscles.

Looss, 1902, observed and reported that the lymphatic tubules of certain amphistomes are contractile. According to him the contractions of the lymphatic tubules themselves causes the circulation of the fluid within the system. Since the time of Looss, no one has been able to verify this observation. In a living amphistome it is not difficult to observe that the lymphatic tubules widen and narrow, but whether this activity is active or passive remains a matter of speculation.

The picture is complicated by several factors. In the living worm, not only is the body itself highly motile, but internal structures, such as the uterus, excretory bladder, and ootype, are all actively contractile. These movements, in the aggregate, could probably explain the flow of lymphatic fluid without the active participation of the lymphatic tubules.

Willey, 1930, rejected the suggestion that the lymphatic structures are contractile. He apparently based his opinion on a study of sectioned material only, however. Willey described lymphatic sinuses near the posterior sucker and also near the anterior sucker. In view of the position of the posterior sinuses, reported by Willey, it is probable that the cuerpecitos of Caballero are homologous to them. The possibility that the cuerpecitos may be contractile lymphatic "hearts" cannot presently be ruled out. That they are heavy-walled and spherical, quite unlike typical sinuses, suggests this possibility. Unfortunately, it was not possible to resolve this question in the field owing to limited facilities. Adult worms of this species are quite large and, hence, difficult to study alive. If immature specimens could be studied alive, perhaps additional light could be shed on this question.

Schizamphistomoides tabascense Caballero and Sokoloff, 1934

Hosts: Dermatemys mawii

Pseudemys scripta ornata

Kinosternon leucostomum

Site: large intestine or cloaca

Geographic range: Veracruz and Tabasco to Panama

This species was originally described from Dermatemys mawii from the state of Tabasco. Rosales, 1951, has also reported the species from the same host at Alvarado, Veracruz. Caballero, Zerecero, and Grocott, 1958, have also reported the species from Pseudemys ornata from Panama. Although large numbers of S. resupinatum were collected during the present study, S. tabascense was infrequently encountered. Two and three specimens were collected from each of the two examples of Dermatemys mawii respectively, and one specimen each was obtained from the other two chelonian host species.

S. tabascense is a large, robust amphistome similar in size and appearance to S. resupinatum. It can easily be distinguished from the latter, however, in either living or fixed specimens. The testes of S. tabascense are diagonally situated while those of S. resupinatum are parallel.

As far as can be determined, S. tabascense is the only species discussed in the present paper that had previously been reported for the state of Tabasco. The present study adds one species to the list of known chelonian hosts of S. tabascense.

Family Angiodictyidae Looss, 1902

Subfamily Octangioidinae Yamaguti, 1958

Octangioides tlacotalpensis Caballero, 1942

Host: *Dermatemys mawii*

Site: lower intestinal tract

Geographic range: Veracruz and Tabasco

In addition to *O. tlacotalpensis*, there is one other species in the genus, *O. skrjabini* Price, 1937. The latter was described from the same chelonian host collected in Mexico. The members of this genus lack an acetabulum, but the posterior end tapers off and ends in two pointed protruberances. Presumably, this unusual posterior appendage serves for attachment in lieu of an acetabulum.

In the present study, about 450 worms of this species were collected. Both of the host animals examined were infected. Most of these specimens have been stained, cleared, and comparatively studied, and both transverse and frontal serial sections have been prepared and studied.

Mature specimens in the collection measure from 1.7 to 3.8 mm. in length. The length given by Caballero was 3.456 mm. *O. skrjabini* was listed as being 1.6 to 2.5 mm. in length. Present specimens are assigned to *O. tlacotalpensis* on the basis of the following characters; the excretory vesicle and canals are comparable to the description given by Caballero; the size and general body and organ configuration are similar; and the intestinal caeca are long and closely approach the excretory vesicle (in *O. skrjabini* the caeca are short and the excretory vesicle is small, which results in the presence of a considerable distance between them). Since the egg size was not given in the

original description of *O. tlacotalpensis*, it is included herein. The eggs measure 0.051-0.064 x 0.089-0.102.

Family Plagiorchiidae Ward, 1917

Subfamily Plagiorchiinae Pratt, 1902

Glypthelmins proximus Freitas, 1941

Hosts: *Coniophanes imperialis clavatus*
Leptophis occidentalis praestans
Thamnophis sauritus chalceus
Leptodactylus ocellatus (Brazil)

Site: upper intestinal tract

Geographic range: Brazil to Tabasco

Illustration: Plate III

The numerous species of the genus *Glypthelmins* have all been described from anuran hosts. In all probability the few specimens of this genus that were recovered from snakes in Tabasco represent infections that were accidentally acquired by the snakes from feeding on frogs. Species of the anuran genus *Leptodactylus* occur in Tabasco, and they are known to form a part of the food supply of the above-listed host snakes. *L. melanonotus* was identified among specimens collected in Tabasco in 1958.

The species of the genus *Glypthelmins* are difficult to determine due to the intraspecific variability found in the group (Rankin, 1944). No attempt can be made here to clarify the synonymy that doubtless exists in this group. Present specimens are assigned to *G. proximus* on the basis of the distribution of the vitellaria, size and position of the cirrus sac, and the relative sizes of the oral sucker, pharynx, and acetabulum. In this species the pharynx and acetabulum tend to be of similar size while the oral sucker is considerably larger.

Plate III illustrates some of the intraspecific variation encountered in the present series. Figure 1 shows a specimen in which the acetabulum is relatively small. The acetabulum in this specimen is smaller than the pharynx or the testes. In sharp contrast is Figure 2 which shows a specimen having an acetabulum that is larger than the pharynx. In the same specimen, the testes are smaller than the acetabulum, and they are nearly equal in size to the ovary. Figure 3 illustrates a specimen in which the testes are smaller than the ovary. All three of these specimens are mature, and they are shown drawn to the same scale.

Subfamily Astiotrematinae Baer, 1924

Parallopharynx arctus Caballero, 1946

Host: *Basiliscus vittatus*

Site: upper intestinal tract

Geographic range: Guatemala and Tabasco

Illustrations: Plates IV and V

Caballero, 1946, described a new genus and species of trematode from the same host species, which had been collected on the banks of the Moca river near the Olas de Moca finca in Guatemala. The description of the species was based on a single specimen. Until the present, no other record of the species has been reported.

Present material consists of 16 whole mounts of entire worms, whole mounts of fragments of 4 additional specimens, and 2 individuals serially sectioned. These specimens came from 10 infections in which from 1 to 4 worms were encountered per infection. Studies of this series showed that the Tabasco material was closely similar to the original description of *P. arctus* in regard to general size and shape

of the body and in the position and structure of the reproductive organs. These facts, plus the common host, led to the conclusion that the specimens from Tabasco were conspecific with Caballero's species.

In studying the series, certain morphological features came to light that had not been reported in the original description. Most notable among these was the presence of two wing-like projections from the antero-ventral margin of the oral sucker. Other undescribed features were the presence of cuticular spination and striking variability in the distribution of vitelline follicles. It was observed that the oral lappets were only visible in some of the specimens in the series. Sections through the lappets showed them to be muscular, hence, it was thought that in some of the specimens these structures were contracted to the extent that they were not visible. Similarly, the cuticular spines were present in some specimens but absent from others. This is not surprising as spines are known to detach readily, and in some cases they are suspected of being deciduous. It was therefore presumed that these characters were absent from the holotype.

Consequently, five preparations from the series were sent to Professor Caballero along with a request that he compare them with the holotype. He very kindly made the comparison, and he expressed complete concurrence with my views (personal communication of December 28, 1960). Professor Caballero suggested that since the several characters did not occur on the type specimen a redescription of the species and an emendation of the generic description should be prepared. These are included herein. The five whole mount preparations

have been deposited in the helminthological collections of the Laboratoria de Helmintologia at the Instituto de Biologia of the Universidad Nacional Autonoma de Mexico where they have been registered under number 218-1.

In the description of P. arctus, given below, the size ranges are listed in millimeters. After each size range, the size listed in the original description is included in parentheses.

Description: The body is narrow, highly attenuated, and flattened dorso-ventrally. The cuticle is thin and contains small spines embedded in it anteriorly. The spines are longer near the anterior extremity and become progressively shorter posteriorly. These spines cover only the anterior one-fourth of the body. The body is 8.8 - 14.20 (11.34) long by 0.488 - 1.22 (1.115) wide. The oral sucker bears two antero-ventral lappets which project laterally. These vary in apparent size with the state of contraction. In no specimen of the series do they project beyond the lateral margin of the body. The oral sucker measures 0.23 to 0.303 (0.315) long by 0.252 to 0.33 (0.328) wide. The prepharynx is long and near its entrance into the pharynx the walls are heavy and muscularized. The prepharynx measures 0.165 long by 0.127 wide (0.105 x 0.210). The prepharynx was measured in a specimen that had the anterior end moderately extended. In specimens having the anterior end contracted the prepharynx appeared wider than long as in the original description. The acetabulum is nearly spherical and measures 0.19 to 0.252 long (0.223) by 0.165 to 0.252 wide (0.227). The pharynx measures from 0.152 to 0.252 in length (0.239) by 0.14 to 0.213 in width (0.231). The oesophagus is quite short.

The anterior testis is 0.42 to 0.62 (0.340) long by 0.28 to 0.50 (0.435) wide. The posterior testis is 0.445 to 0.89 (0.378) in length by 0.318 to 0.82 (0.472) in width. The cirrus sac is quite large being 1.65 to 2.30 (0.966) long by 0.165 to 0.19 (0.189) wide. The ovary measures 0.19 to 0.38 (0.359) long by 0.28 to 0.484 (0.416) wide. The eggs are from 0.0208 to 0.0242 (0.022 - 0.024) long by 0.0108 to 0.0139 (0.011 - 0.013) wide.

The vitellaria are highly variable in extent and position. In the type specimen the vitellaria form three main groups on each side. There is a post-testicular group, an inter-testicular group, and a pre-testicular group. In a few of the specimens of the present series, the vitelline glands are similarly arranged. In other specimens, however, there are no vitellaria posterior to the anterior margin of the anterior testis. There may be two groups of vitellaria anterior to the testes, or these may fuse to form one group. In still other specimens, there are two distinctly separated groups of vitelline glands anterior to the testes as well as inter-and post-testicular ones. In the latter case the result is four distinctly separated groups of vitelline follicles. Plate V is illustrative of these intraspecific variations.

Discussion: It can be seen from the above comparative description that in most cases the range of sizes in the present collection encompasses the published measurements of the type specimen of Caballero's species. In view of the oral lappets, the cuticular spination, the nature of the prepharynx, and the variability of the vitellaria, it is necessary to suggest certain additions to the generic diagnosis. For this reason, the most recent generic diagnosis (Yamaguti, 1958) is given below with the suggested additions included. The additions are

underlined.

Parallopharynx Caballero, 1946

Generic diagnosis. Plagiorchiidae, Astiotrematinae: Body slender, flattened cylindrical, with or without spines. Acetabulum small, in anterior third of body; Oral sucker larger than acetabulum, and with two wing-like lappets which project laterally from the antero-ventral margin. Prepharynx present, relatively long, and quite muscular especially near the posterior end. Pharynx comparatively large. Oesophagus very short. Intestinal bifurcation a considerable distance anterior to acetabulum; caeca reaching to posterior extremity; Testes tandem, near posterior end of body, separated by uterus. Cirrus pouch elongate, extending far back of acetabulum, enclosing winding seminal vesicle and well developed prostatic complex. Genital pore slightly out of median line, pre-acetabular. Ovary post-equatorial, nearer to anterior testis than to acetabulum. Receptaculum seminis and shell gland posterior to ovary. Laurer's canal present. Uterus in transverse coils, passing between two testes and reaching to near caecal ends, but not to posterior extremity. Metraterm shorter than cirrus pouch. Vitelline follicles extending in lateral fields of hindbody, variable in extent and position; usually extend from some distance ahead of ovary to the anterior testis, may be divided to form two distinct groups of follicles, one pre-ovarian and one post-ovarian, with or without inter-testicular and post-testicular groups of vitelline follicles. Lateral excretory ducts reaching to oral sucker. Intestinal parasites of Iguanidae.

Subfamily Opisthogoniminae Travassos, 1928

Opisthogonimus tabascensis n. sp.

Host: *Coniophanes quinquevittatus*

Site: oral cavity

Geographic range: Tabasco

Illustration: Plate VI

In 1958 a single infection numbering seven worms was encountered in Tabasco. Six of these were prepared as whole mount slides while the seventh was serially sectioned. Four of the whole specimens are in dorso-ventral compression, and two slides are of specimens that were laterally flattened. The measurements given in the description are of the holotype, and all measurements are in millimeters.

Description: *Opisthogonimus tabascensis* has the characteristics of the genus. The body is broadly rounded anteriorly and tapers sharply towards the posterior extremity. The cuticle bears spines that cover the body to near the posterior end. The body is 2.2 in length, and it reaches a maximum width of 1.1 at the level of the pharynx.

The oral sucker is large and sub-terminal and measures 0.456 in length by 0.47 in width. A prepharynx of moderate length is present. The pharynx is 0.152 in length and 0.216 in width at its anterior margin. The pharynx is wider anteriorly and tapers towards its posterior end. The oesophagus is very short. The intestinal caeca extend to near the posterior end of the body. The acetabulum is relatively small and measures 0.27 long and 0.318 wide. The acetabulo-oral sucker ratio is, therefore, about 1:1.5.

The spherical testes are situated diagonally in the posterior

portion of the middle third of the body. The anterior testis measures 0.242 in length by 0.292 in width. The posterior testis is 0.254 long by 0.33 wide. The cirrus pouch is relatively long and slender and is situated to the left of the acetabulum and anterior to that structure. The cirrus sac has an angular bend in it anteriorly. It contains a small seminal vesicle and prostatic cells. The cirrus sac measures 0.445 in total length by about 0.051 in width. The genital aperture is situated immediately posterior to the acetabulum and somewhat to the left of the mid-line of the body.

The ovary is large and is situated on the right side of the body in the acetabular region or is slightly pre-acetabular. The ovary measures 0.292 in length by 0.254 in width. The small seminal receptacle and Mehlis' gland are located just posterior to the ovary. The vitelline follicles are dorsally located in the caecal and inter-caecal zones. They extend from the level of the pharynx to the posterior margin of the testes. The individual vitelline follicles are of the magnitude of 0.064 in diameter. The uterus fills the posterior half of the body from the posterior margin of the acetabulum to near the termination of the caeca.

The numerous eggs in the uterus are relatively small, and they measure 0.0121 to 0.0156 wide by 0.0243 to 0.026 in length.

Discussion: Most of the described species in this genus are elongate forms with equal or subequal suckers and therefore do not warrant detailed comparison to the present species. O. tabascensis somewhat resembles O. serpentis Artigas, Ruiz, and Leao, 1943. It can be seen from the following table of comparisons that O. tabascensis differs from O. serpentis in several respects. O. tabascensis is

smaller, less attenuate, and it has relatively larger suckers than does O. serpentis. The oral sucker and pharynx are relatively larger in O. tabascensis. The vitellaria of O. tabascensis reach a level anterior to the acetabulum while in O. serpentis they reach only the posterior border of the acetabulum. The eggs of the new species are somewhat smaller than those of the Brazilian species.

Table IiI Dimensional Comparisons of *Opisthogonimus tabascensis* and *Opisthogonimus serpentis*

		O. tabascensis	*O. serpentis*
body:	length	2.2	4.6-6.7
	width	1.1	0.93-1.20
oral sucker:	diameter	0.456-0.47	0.494-0.636
acetabulum:	diameter	0.27-0.318	0.395-0.452
pharynx:	length	0.152	0.130
	width	0.216	0.225
anterior testis:	length	0.242	0.339-0.494
	width	0.292	0.296-0.297
posterior testis:	length	0.254	0.367-0.537
	width	0.33	0.353-0.438
ovary:	diameter	0.254-0.292	0.212-0.395
eggs:		0.0121-0.0156 x 0.0243-0.026	0.014-0.016 x 0.025-0.030

Subfamily Styphlodorinae Dollfus, 1937

Styphlodora horrida (Leidy, 1850)

Hosts: *Spilotes pullatus mexicanus*

Bothrops atrox aspera

Coniophanes quinquevittatus

Constrictor constrictor imperator

Dryadophis melanolomus veraecrucis

Drymarchon corais melanurus

Lampropeltis triangulum polyzona

Natrix rhombifera werleri

Sites: ureters, pelvis of kidney, and cloaca

Geographic range: probably ranges throughout the neotropical region from southern Mexico to southern Brazil, and Trinidad

Illustration: Plate VII

Numerous specimens of the genus *Styphlodora* were collected in Tabasco from each of the above-listed host snakes. The largest infections were consistently encountered in *Spilotes pullatus*. The largest single infection was from that host, and it numbered 160 individuals. A representative collection of about 300 specimens has been stained, cleared, and studied.

The most extensive papers dealing with the genus *Styphlodora* are those of Byrd, Parker, and Reiber (1940), and the more critical reviews of Dawes (1941, 1942). Each of these three papers presents a key to the known species in the genus. There have been some 19 species described in the genus, although as Dawes suggests, probably not more than 14 may be considered as valid. Dawes (1942) pointed

out many flaws in the work of Byrd et al and showed rather convincingly that their key had been based on characters already known to be unreliable, and in some cases proven artifacts were involved. The present study tends to corroborate these assertions of Dawes.

Studies of the present series have led to the conclusion that only a single species is represented. These worms show close morphological affinity to S. horrida (Leidy, 1850), S. lachesidis MacCallum, 1921, and S. condita Gomes de Faria, 1911. Each of these forms was described from a neotropical snake, and each of these host species appears in the present host list. The holotype of S. horrida was from a specimen of Constrictor constrictor that died in captivity in Philadelphia. The exact site of geographic origin of the material is unknown. S. condita was described from Spilotes pullatus in Brazil, and S. lachesidis came from the Fer d' lance, Bothrops atrox, on the island of Trinidad. Present material most closely resembles the descriptions of S. lachesidis. Dawes (1942) placed the latter in synonymy with S. horrida on the basis of what he discovered relative to the effect of growth and size on the position and size relationships of the various organs. The only apparent difference between S. lachesidis and S. horrida is the smaller testes of the latter. It is not known if small testes were constant throughout the series of 26 specimens examined by Leidy as he only described and figured the holotype. Although the plate that Leidy published is excellent, his description is of little use in solving systematic problems at the present time. Leidy believed the vitellaria to be the ovary, and the ovary, seminal receptacle, and the two testes were all called testes. Few measurements were given, and some discrepancies exist in these, as pointed out by Dawes. Present material tends to bear out

Dawes' contention that the two names are synonymous. Several specimens in the Tabasco material have small testes that closely approximate the condition as illustrated by Leidy. Present specimens are therefore assigned to S. horrida, which name has priority over S. lachesidis.

That S. condita may be another synonym of S. horrida is a distinct possibility, but this cannot be categorically asserted at the present time. S. condita is said to be characterized by the presence of large testes that are transversely oval. The anterior testis extends from one caecum to the other. This condition could not be found in the present series. The testes were found to be highly variable, however. The testes were seen to vary in size, relative position, and in shape. The transverse elongation of the testes in the holotype of S. condita may possibly be the result of fixation under pressure.

Ochetosoma Braun, 1901

Species of this genus are common parasites of the mouth, oesophagus, trachea, and lung of snakes throughout the world. Until recently, many of these forms had been known under the generic name Renifer Pratt, 1902. Leao, 1945, showed convincingly that both Pratt and Braun had described the same genus, and that Ochetosoma had priority even though Renifer enjoyed the widest usage. Both Yamaguti (1958) and Skriabin (Vol. XIII, 1957) followed the suggestions of Leao and recognized Ochetosoma as the valid name.

The determination of species in the genus presents certain problems as there is much intraspecific variation to be found. Yamaguti (1958) listed 30 species in the genus. These species are easily separable

into two groups on the basis of the distribution of vitelline follicles. The first group, as exemplified by O. aniarum (Leidy, 1890), has a discontinuous distribution of vitellaria. On each side of the body there are two distinct groups of vitelline follicles. In the other group of species, the distribution of vitellaria is continuous. On each side of the body a single group of vitelline follicles extends from about the level of the testes to the level of the acetabulum or beyond. All of the specimens of Ochetosoma that were collected in Tabasco for the present report belong to the latter morphological group.

Thousands of specimens of Ochetosoma were seen in snake hosts during the field portion of the present study. Some 500 of these specimens were retained for detailed laboratory studies. The collection includes representative series from each of the host species in which the genus was encountered. All of these specimens have been stained, cleared, and studied comparatively. These studies have led to the conclusion that only a single species of Ochetosoma is represented in the collection from Tabasco. It has thus been possible to evaluate some of the characters that have previously been proposed as valid determinants of specific distinctness.

Caballero, 1949, reported the presence of Neochetosoma crotali (Self, 1945) in a Fer d' Lance (Bothrops atrox) from Boca del Rio, Veracruz, Mexico. In that paper he pointed out that there was a considerable variation in the size of mature individuals and in the form of various organs. He found that the posterior termination of the caeca varied from the middle of the acetabulum to the level of the anterior margin of the testes. In some specimens the caeca were

diverted inward so as to be contiguous with the antero-median aspect of the testes. The testes were found to vary from smoothly spherical to prominently notched or lobulate. The configuration and extent of the uterine folds appeared to depend on the number of eggs present in that organ. The posterior extent of the vitellaria was seen to vary from the anterior margin of the testes to slightly beyond the posterior borders of those structures. Present studies tend to corroborate the variability in these characters as reported by Caballero.

In single series from individual hosts, present material shows a variation in the extent of the caeca from well anterior to the testes to considerably posterior to those organs. The vitellaria can be seen to vary in posterior extent from the level of the anterior margin of the testes to well beyond them. Anteriorly the vitellaria vary in extent between the anterior margin of the acetabulum to the area of the intestinal bifurcation.

In specimens which have caeca extending to or beyond the testes, the caeca usually can be seen to pass the median face of those organs. In a few of these specimens, however, the caeca pass the testes dorsally or laterally.

Present material is regarded as conspecific with Ochetosoma ellipticum (Pratt, 1903). The latter is apparently a nearctic species having been reported from various hosts in the United States. It has also been reported from Panama (Flores-Barroeta and Grocott, 1953).

Ochetosoma ellipticum (Pratt, 1903)

Hosts (United States):

Heterodon contortrix

Lampropeltis getulus holbrooki

Hosts (Panama):

Erythrolamprus aesulapii

Xenodon columbrinus

Hosts (Tabasco):

Bothrops atrox aspera

Clelia clelia clelia

Coniophanes bipunctatus biseriatus

Coniophanes imperialis clavatus

Coniophanes quinquevittatus

Dryadophis melanolomus veraecrucis

Drymarchon corais melanurus

Drymobius margaritiferus margaritiferus

Leptodeira septentrionalis polysticta

Leptophis mexicana mexicana

Leptophis occidentalis praestans

Micrurus affinis alienus

Pliocercus elapoides elapoides

Thamnophis sauritus chalceus

Site: mouth and oesophagus, sometimes trachea and lung

Geographic range: United States to Panama

O. ellipticum was the commonest trematode encountered in Tabasco. In many of the host species the infection rate was at or near 100%, and individual infections of from 200 to 500 worms were often seen. Present material closely compares with the descriptions of Pratt, 1903, and Flores-Barroeta and Grocott, 1953.

The most reliable criteria for the determination of this species have been found to be the position of the genital aperture and the

relative length of the oesophagus. Although the apparent position of the genital pore may vary with the amount of contraction or compression of a specimen, in the majority of cases it is situated considerably to the left of the mid-line at the level of the oesophagus. This character serves to separate O. ellipticum from O. crotali (Self, 1945) and O. grandispinum (Caballero, 1938). The latter two species have the genital pore at the level of the pharynx.

The oesophagus is always a prominent structure in O. ellipticum. Contracted specimens show the oesophagus as relatively short and wide while extended specimens have an elongate and slender oesophagus. Whatever the state of contraction of the worm, this character can be used reliably to separate O. ellipticum from several described species which have a short oesophagus.

Whether O. ellipticum is separable from O. ancistrodontis (MacCallum, 1921) could not be determined. The latter is morphologically quite similar to present material but MacCallum's species show a separation of the metraterm and cirrus. This single character was used by Byrd and Denton, 1938, to distinguish these species. MacCallum based his description on a single specimen so the relative constancy of the above character is unknown.

The present paper reports O. ellipticum in Mexico for the first time, and adds 14 ophidian species to the list of known hosts.

Parahaplometroides basiliscae n. gen. and n. sp.

Host: Basiliscus vittatus

Site: mouth and auditory canals

Geographic range: Tabasco

Illustration: Plate VIII

Numerous examples of a large, muscular trematode were encountered in the oral cavity of the lizard Basiliscus vittatus. Some 57% of the hosts examined were found to be infected, and infections consisted of from one to twenty individuals. Studies of 35 whole mounts and one serially sectioned specimen have led to the conclusion that this form cannot be placed in any of the existent genera. The name Parahaplometroides is hereby proposed to indicate an apparent relationship to the genus Haplometroides Odhner, 1911, which was described from the mouth of a snake from Paraguay. P. basiliscae was not encountered in any other host animal, and for this reason it is believed to be rather host specific. The species name has been selected to indicate this relationship.

Generic description: This genus has the characteristics of the subfamily Styphlodorinae, and it plainly belongs with that group as defined by Dollfus, 1937. The body is robust, muscular, slightly flattened, and bluntly rounded at each extremity. The cuticle is thick, and it contains long spines. Spines cover the anterior two-thirds of the body, and they terminate at a slightly post-testicular level. The oral sucker is large, subterminal, and nearly equal in size to the acetabulum. The acetabulum is situated about one-third of the body length from the anterior end. Pharyngeal glands are present. Both a prepharynx and oesophagus are present and of moderate length. The intestinal caeca are long, but they fail to reach the posterior extremity.

The testes are diagonally situated in the posterior half of the body. The cirrus and cirrus sac are large and mainly pre-acetabular in position. The seminal vesicle is contained within the cirrus sac,

and it is extensively coiled. The genital pore is antero-dextral to the acetabulum.

The ovary is situated a short distance behind the acetabulum on the left side. A seminal receptacle is located immediately dorsal to the ovary, and a Laurer's canal is also present. The follicular vitellaria are dorsal to the caeca, and they extend from the posterior margin of the acetabulum to the level of the posterior margin of the anterior testis, or slightly beyond. The urerus coils between the testes and fills the post-testicular region of the body. The metraterm is strongly muscular and about half the length of the cirrus sac.

The excretory bladder is Y-shaped.

Discussion: Parahaplometroides appears to be quite distinct from other known genera in the family Plagiorchiidae. Its closest resemblance is to a form described from the mouth of a South American snake (Elaps sp.) by Odhner, 1911, which he called Haplometroides buccicola. Present material resembles Odhner's in the general distribution of the vitellaria and in the lateral displacement of the ovary and genital aperture.

The present form differs from Haplometroides in a number of characteristics that are believed to be of generic significance. In Haplometroides the genital pore is antero-sinistral to the acetabulum, and the ovary is to the right of the median line. In the present form, the genital pore is antero-dextral, and the ovary is on the left. In Odhner's form the acetabulum and cirrus sac are both small while in Parahaplometroides both of these structures are large and prominent. The new genus differs further from Haplometroides in possessing pharyngeal glands, a highly convoluted seminal vesicle, and intestinal caeca

that are nearly full length. All of these factors, considered in the aggregate, have led to the conclusion that present material represents a previously undescribed genus.

Generic diagnosis. Plagiorchiidae, Styphlodorinae: Body robust, little flattened, with cuticular spination on anterior two-thirds. Acetabulum large, in anterior third of body. Oral sucker large, nearly equal to acetabulum. Pharynx moderately large, surrounded by glandular cells. Prepharynx and oesophagus both present, of moderate length. Intestinal caeca slender, extending to near the posterior extremity. Testes two, diagonal, in posterior half of body. Cirrus sac and cirrus large. Cirrus sac contains convoluted seminal vesicle. Ovary post-acetabular, to left of mid-line. Vitellaria dorso-lateral to caeca, between acetabulum and posterior margin of anterior testis. Seminal receptacle and Laurer's canal present. Uterus descends to posterior extremity of body, ascends to genital pore. Genital pore antero-dextral to level of intestinal bifurcation. Metraterm one-half the length of cirrus sac. Eggs small and numerous. Excretory system Y-shaped. Parasites of oral cavity of Iguanidae.

Specific description: A specimen of intermediate size has been selected for use as a holotype, and measurements are given for that individual. After each measurement the extremes are given in parentheses. These have been arrived at by measuring the smallest and largest specimens in the series. All of the measurements listed are in millimeters.

<u>Parahaplometroides basiliscae</u> has the generic characteristics that are listed above. The body is 8.60 (5.0-10.9) long by 2.38 (1.46-2.67) wide. The cuticle is relatively thick, and it measures 0.0138-

0.0945 in thickness. The slender cuticular spines are shorter near the anterior end of the body where they average about 0.0242 in length. The spines become progressively longer posteriorly until a maximum length of about 0.059 is reached slightly behind the level of the posterior testis, at which level the spination ends abruptly leaving the remainder of the body unarmed.

The oral sucker is sub-terminal, and in certain stages of contraction of the worm it gives the appearance of being overhung by a slight dorsal lip. The oral sucker is slightly wider than long, and it measures 0.71 (0.456-0.685) long by 0.76 (0.456-0.762) wide. The prepharynx and oesophagus are relatively wide while the intestinal caeca are relatively slender. The caeca reach to within 1.15 (0.635-1.25) of the posterior end. The spherical pharynx measures 0.38 (0.254-0.482) in diameter. The acetabulum is nearly equal in size to the oral sucker. The acetabulum measures 0.75 (0.456-0.762 in diameter.

The testes are diagonally situated in the post-equatorial body region. They tend to be slightly oval in shape, and they are usually longer than wide. The anterior testis measures 1.20 (0.735-1.22) in length by 0.98 (0.66-1.08) in width. The posterior testis is quite often larger than the anterior one, and it measures 1.27 (0.76-1.28) in length by 0.965 (0.70-1.01) in width. The cirrus and cirrus sac are large and prominent structures. The cirrus sac measures 1.15 (0.70-1.15) in length by 0.445 (0.292-0.445) in width. The cirrus sac contains a convoluted seminal vesicle and prostatic cells.

The spherical ovary is located a short distance posterior to the acetabulum and well to the left of the median line. The ovary is 0.60

(0.507-0.736) in diameter. The vitellaria are follicular, mostly dorsal to the caeca, and they extend a variable distance medially to the caeca. Individual vitelline follicles range in size from 0.064 to 0.127. The relatively small seminal receptacle is situated dorsally to the ovary, and it is quite variable in size. The Laurer's canal proceeds medially and then dorsally from the ootype to open on the dorsal body surface.

The ovoid, operculate eggs are very numerous in the uterus. The eggs measure 0.0208-0.0242 x 0.0485-0.052.

Discussion: As stated in the discussion above, P. basiliscae somewhat resembles one of the species of the genus Haplometroides Odhner, 1911. There are presently only two species described in that genus. These are H. buccicola Odhner, 1911, and H. rappiae Szidat, 1932. The latter was described from Rappia concolor taken in Liberia. H. rappiae has very small suckers, a small cirrus sac, and the testes are parallel. Hence, it bears little specific resemblance to the form presently under consideration. A detailed comparison is, therefore, unnecessary.

P. basiliscae differs from H. buccicola in the following specific characteristics. It is considerably larger and more robust. The maximum size recorded for H. buccicola is 6 mm. while the present form reaches nearly 11 mm. in length. In the present species the acetabulum is large, and equal in size to the oral sucker. In H. buccicola, on the other hand, both suckers are small, and the acetabulum is considerably smaller than the oral sucker. In Odhner's species the vitellaria extend from the anterior margin of the acetabulum to the anterior margin of the posterior testis. In the new genus the vitellaria

are more limited in extent, and they reach only from the posterior margin of the acetabulum to the posterior margin of the anterior testis. While the caeca of P. basiliscae nearly reach the posterior end of the body, in Odhner's species the caeca barely reach into the posterior one-third of the body. The eggs of H. buccicola measure 0.043-0.046 in length as compared to 0.0485-0.052 for the present species.

Subfamily Telorchiinae Looss, 1899

Telorchis Luehe, 1900

The genus Telorchis contains more than 45 described species that are found in the digestive tract of turtles throughout the world. Many of these species were formerly placed in the genus Cercorchis Luehe, 1900, but currently (Yamaguti, 1958) these names are regarded as synonyms, and Telorchis is recognized as valid. The historical facts upon which this conclusion is based are adequately reviewed by Wharton (1940).

The most comprehensive study of the genus Telorchis is that of Wharton (1940) who presented an illustrated key to the separation of those species that he found to be morphologically distinguishable. During the course of his study, he found a number of characters that could be regarded as sufficiently constant to be of value in the determination of species. In this regard Wharton stated, "Characters which are to be considered as different and constant enough upon which to determine species are: extent of vitellaria, position of ovary, relative length of cirrus sac, relative length of metraterm, size of suckers, position of acetabulum, size of pharynx, length of oesophagus, extent of intestinal crura, and special features such as the presence

of a muscular bulb on the metraterm or the presence of small lappets on the oral sucker."

Although each of these characters may show a considerable amount of intraspecific variation, they may reasonably be used in the aggregate to determine species.

Telorchis corti Stunkard, 1915

Hosts (Mexico):

Pseudemys scripta ornata

Chelydra serpentina

Claudius angustatus

Leptophis occidentalis praestans

Geomyda areolata (Veracruz)

Kinosternon integrum (Morelia)

Hosts (United States):

Chelydra serpentina

Chrysemys elegans

Clemmys marmorata

Deirochelys reticularia

Malacoclemmys geographicus

Malacoclemmys lesiuri

Pseudemys troostii

Sternotherus odoratus

Site: upper intestinal tract

Geographic range: United States and Mexico

Telorchis corti is apparently a nearctic species having a wide distribution in North America. It has previously been reported from the states of Morelia (Bravo-Hollis, 1944) and Veracruz (Rosales, 1951).

This species is characterized by being highly attenuated. The vitellaria begin anteriorly between the acetabulum and the ovary. The cirrus sac is long and slender. The ovary is situated nearer to the acetabulum than to the testes. The metraterm is shorter than the cirrus sac, and the suckers are about equal in size. (Wharton, 1940).

Specimens in the present collection show the above characters and are therefore assigned to this species. T. corti was found to be a common parasite of Pseudemys scripta ornata in Tabasco. Of the 22 hosts examined, 11 were found to harbor this worm, and the largest infection contained 65 individuals. T. corti was only occasionally encountered in Claudius angustatus, and three specimens were recovered from Chelydra serpentina. Additionally, one specimen each came from Kinosternon leucostomum and the snake, Leptophis occidentalis praestans. The latter is believed to be the first report of the occurrence of T. corti in an ophidian host.

The present paper represents the first report of T. corti in Tabasco, which may be near the southernmost portion of the range of the species. Three species are herein added to the list of known hosts of T. corti.

Telorchis patonianus (Caballero, 1935)

Hosts: Claudius angustatus
Staurotypus triporeatus
Dermophis mexicanus (Veracruz)

Site: upper intestinal tract

Geographic range: Veracruz and Tabasco

Caballero, 1935, described a telorchid from the state of Veracruz

that he called Cercorchis patonianus. He based his description on two specimens from the intestinal tract of the caecilian, Dermophis mexicanus.

During the present study, trematodes having the same diagnostic characteristics as Caballero's species have been found in Tabasco. This form was often encountered in the above-listed chelonian hosts. A total of 52 specimens of T. patonianus have been studied from these hosts. Although four specimens of Dermophis mexicanus were examined in Tabasco, no trematodes were found in these caecilians. In view of these facts, it seems probable that the caecilian is an accidental host for T. patonianus.

Present material compares quite closely to Caballero's published description. T. patonianus is easily distinguishable from other species in the genus by the distribution of the vitellaria. In this form, the vitellaria begin at the level of the anterior margin of the acetabulum, and they extend posteriorly to near the level of the anterior testis. The testes, however, are situated at some distance from the posterior end of the worm, and they are not usually terminal as in most other telorchids. Another striking feature of this species is its very elongate oesophagus.

Mature specimens in the present series measure from 1.85 to 5.35 mm. in length. In the original description, the length is listed as from 4.290 to 5.445 mm.

The present paper is believed to constitute the second report of T. patonianus, and it is the first record of the species in Tabasco. The presence of this form in two species of turtles is herein reported for the first time, and these hosts are regarded as the natural

definitive hosts of this parasite.

Telorchis pseudoaculeatus Dollfus, 1929

Hosts: Constrictor constrictor imperator

Natrix rhombifera werleri

Ninia sebae sebae

Natrix grahamii (United States)

Kinosternon sp. (Costa Rica)

Site: upper intestinal tract

Geographic range: Southern United States to Costa Rica

Trematodes believed to be conspecific with T. pseudoaculeatus were encountered in 7 of the 31 specimens of Natrix rhombifera werleri. The largest infection contained 11 individuals. A few specimens of this species were also found in Constrictor constrictor imperator, and a single specimen was taken from Ninia sebae sebae.

In this form the vitellaria begin at the level of the anterior margin of the ovary. The metraterm is shorter than the cirrus sac. The cirrus sac is relatively shorter than in T. corti. The posterior end of the cirrus sac is near the ovary, and the oral sucker is larger than the acetabulum. (Wharton, 1940).

As far as could be determined, this species has not been reported previously from Mexico. It has been reported in Kinosternon sp. in the Republic of Costa Rica, however. (Caballero and Brenes, 1957). The present paper adds three species to the list of known hosts.

Family Brachycoeliidae Johnston, 1912

Subfamily Mesocoeliinae Dollfus, 1929

Mesocoelium travassosi Pereira and Cuocolo, 1940

Hosts: *Ninia sebae sebae*

Ameiva undulata amphigramma

Drymobius margaritiferus margaritiferus

Leptophis mexicana mexicana

Leptophis occidentalis praestans

Mabuya brachypoda

Eumeces sp. (Oaxaca)

Bufo marinus (Costa Rica)

Site: upper intestinal tract

Geographic range: Brazil, Costa Rica, Oaxaca, and Tabasco

Illustration: Plate IX

Some 93 specimens of *Mesocoelium* were collected from 6 host species in Tabasco. These worms were most commonly encountered in the snake, *Ninia sebae*, and the largest infection, of 57 individuals, was from that host. A representative series of whole mounts and serial sections of two individuals have been studied.

These studies have led to the conclusion that only a single species of *Mesocoelium* is represented. There can be no doubt that present material is conspecific with the form described by Pereira and Cuocolo, 1940. Several specimens in the series show exactly the same relative position of the vitellaria and have the genital pore at the level of the pharynx, as described by the Brazilian authors. Although both of these characters are variable, they can be useful in species determina-

tion if used with discretion. Caballero and Brenes, 1958, reported M. travassosi from a toad, Bufo marinus, in Costa Rica, and they noted intraspecific variation in the position of the vitellaria. They state, "La porcion anterior del cuerpo de estos parasitos es sumamente contractil, lo que se traduce por una variacion en el inicio de las glandulas vitelogenas, pues en animales contraidos estas suben hasta nivel de la ventosa oral y en no contraidos unicamente hasta nivel del borde posterior de la faringe, como hemos podido comprobar en nuestros ejemplares." The present study tends to corroborate this finding of Caballero and Brenes. The present study also shows that the state of contraction of the worms influences the apparent position of the genital aperture. Thus, the genital pore may appear to be at any level between the intestinal bifurcation and the anterior border of the pharynx. Similarly, the prepharynx and oesophagus may appear to be of moderate length or very short depending on the state of contraction of the body.

One other species of the genus Mesocoelium has been reported from southern Mexico. This is M. leiperi Bhalerao, 1936, which Zerecero (1950) reported from Eumeces sp. in the state of Oaxaca. M. leiperi is said to differ from M. travassosi in having the genital pore posterior to the intestinal bifurcation, and in having relatively smaller vitelline follicles.

M. travassosi was described from the intestinal tract of a toad, Bufo sp., that came from the state of Paraiba in Brazil. It has been reported from Costa Rica in a toad and from Oaxaca, Mexico in a skink, Eumeces sp. Three published descriptions of this species exist. These are; Pereira and Cuocolo, 1940, Zerecero, 1951, and Caballero and Brenes, 1958. It is unnecessary, therefore, to include any additional descrip-

tion herein. The present paper extends the known range of the species to Tabasco, and reports six new reptilian hosts.

Family Dicrocoeliidae Odhner, 1911

Subfamily Dicrocoeliinae Looss, 1899

Infidum similis Travassos, 1916

Hosts (Brazil):

Drymarchon corais corais

Bothrops jararaca

Eudryas bifossatus

Leimadophis poecilogyrus

Liophis miliaris miliaris

Hosts (Tabasco):

Drymarchon corais melanurus

Bothrops atrox aspera

Clelia clelia clelia

Coniophanes bipunctatus biseriatus

Coniophanes quinquevittatus

Leptodeira septentrionalis polysticta

Leptophis occidentalis praestans

Micrurus affinis alienus

Natrix rhombifera werleri

Thamnophis sauritus chalceus

Staurotypus triporeatus

Site: common bile duct and gall bladder

Geographic range: Paraguay and Brazil to Tabasco

Illustrations: Plates X, XI, and XII

Representatives of the genus *Infidum* were among the most commonly encountered trematodes of this study. Several thousands were seen during the course of the field collecting. These worms were found in

ten different species of snake host and in one species of carnivorous turtle. Since much variation was apparent in these worms, it was presumed that several species of Infidum might be present. A series of about 3000 specimens was, therefore, retained, and subsequently, more than 2000 of these were stained, cleared, and comparatively studied. Several worms were also studied in serial section.

As a result of these comparative studies, much variation came to light, but it is believed that all of the Tabasco material is conspecific with Infidum similis Travassos, 1916.

Infection rates for I. similis was found to be quite high, and heavy individual infections were often seen. The host of preference in Tabasco seemed to be the Mexican indigo snake, Drymarchon corais melanurus. Massive infections of from 200 to 400 worms were common in that host, and one infection of more than 600 individuals was encountered.

Tne gall bladder is usually listed as the site of infection of this species, but it was found that the common bile duct is the more usual locus. Sometimes the worms can be found in the gall bladder, but in that location they are never so numerous as in the common bile duct. In massive infections the bile duct becomes completely packed and distended with these worms along its total length from the gall bladder to the intestinal tract. In such an infection it is common to find one or two individuals in the gall bladder as though they had accidentally been crowded out of the common bile duct. No specimens of Infidum were encountered in the lumen of the intestinal tract.

No grossly pathological changes in the host tissue could be seen in light to moderate infections. In massive infections, however, the

common bile duct was seen to be greatly convoluted, irregularly distended, and somewhat discolored. In fresh dissection the normal bile duct appeared as a light pink or whitish tubule, whereas the heavily infected duct was a blotchy red or light purple in color. This color difference was probably caused by small localized haemorrhaging. Additionally, in massive infections the gall bladder was found to be distended with a clear watery liquid as though the physical presence of the worms in the common bile duct had nearly blocked the normal flow of bile through that tubule.

Travassos described I. similis in 1916 from Brazilian material. In 1942, Ruiz and Leao published the description of I. intermedium from the same country. In 1944, Travassos published an extensive monograph on the Dicrocoeliidae in which he pointed out the extreme variability to be found in I. similis, and he placed I. intermedium in synonymy with I. similis.

The present study can add very little to the published descriptions of Travassos. However, neither I. similis nor I. intermedium has been reported to have spination. The majority of specimens in the present collection have cuticular spines that extend from the anterior end to about level with the ends of the intestinal caeca. These spines are small, and apparently they are easily lost as many specimens lack them. Only the type species of the genus, I. infidum Gomes de Faria, 1910, has been reported to have spines. The latter can be distinguished from I. similis by the more anterior extent of the vitellaria. In I. infidum the vitellaria extend anteriorly to the level of the genital aperture, or beyond, while in I. similis the vitellaria terminate at the level of the anterior margin of the

acetabulum, or slightly beyond.

Intraspecific variation: The intraspecific variability that has been observed in this trematode in all probability arises from three separate causes. These three are; genic mutation, effects of differences in host physiology, and infection of the parasites by microsporidian hyperparasites. These three factors and the variation caused by them shall be considered separately.

Travassos, 1944, reported the occurrence of a single specimen in his series that had both sets of vitelline glands on the same side of the body. Similarly, in the present series from Mexico, one specimen has been found with the same arrangement of vitelline structures. The low incidence of this anomaly and the normal appearance of the worm in other respects suggest the probability that a genic mutation may be responsible.

The effect of host physiology on the morphology of the parasite is difficult to assess. This phenomenon is known to occur, however. One of the most convincing studies in this regard is that of Beaver, 1937. By physically transplanting trematodes of one species to different host species, he was able to demonstrate intraspecific variation that had previously been regarded as interspecific in nature. The same factor can probably account for some of the variability of I. similis. Specimens from Coniophanes bipunctatus biseriatus, for example, were invariably small (1.12-2.25 mm.). Although these worms were mature, they had testes about half the diameter of the acetabulum (Plate XI, Fig. 2). Specimens from Thamnophis sauritus chalceus and the turtle, Staurotypus triporcatus, showed the same size relationship of testes to acetabulum, but they ranged in over-all length from 4 to 4.5 mm.

(Plate XI, Fig. 1). Specimens from Drymarchon corais melanurus are nearly all in the same size range, but they have testes that are from 1.5 to 2.0 times the diameter of the acetabulum (Plate XI, Fig. 3). Significantly, the specimens having the largest relative testis size in Brazil, as reported by Travassos, were those from Drymarchon corais corais. The largest specimens of I. similis from Tabasco were those from the Coral snake, Micrurus affinis alienus (Plate XI, Fig. 4). Plate XI shows that the major morphological features of mature specimens of I. similis from four different host species.

Plate XII represents a growth series taken from a single light infection of Drymarchon corais melanurus. By comparing Plates XI and XII, it can be seen that even the small immature specimen (Plate XII, Fig. 1) has relatively larger testes than does the mature specimen from Coniophanes bipunctatus biseriatus (Plate XI, Fig. 2). It can further be seen that the smallest mature specimen in the growth series (Plate XII, Fig. 2), although of about the same size as specimens from C. bipunctatus, has a testiculo-acetabular ratio typical of larger specimens from Drymarchon corais. Specimens of I. similis having the relatively larger testes were encountered in Leptodeira septentrionalis polysticta and Leptophis occidentalis praestans as well as in the Indigo and Coral snakes. In all of the other hosts listed, forms having testes smaller than the acetabulum were invariably encountered. These intraspecific variations may possibly be attributable to the effects of differences in host physiology on the morphology of the worm.

In his 1944 monograph Travassos briefly reported the occurrence of a microsporidian hyperparasite in Infidum similis. Curiously, the material from Mexico has also been found to be infected with micro-

sporidia. This hyperparasitic organism is the apparent cause of much variation. High infection rates of the microsporidian were often encountered, especially in trematodes from massive infections. This might be expected as in massive infections much crowding results that must facilitate the passage of the parasite from one trematode to another. Although it has not been possible to observe all of the stages in the life cycle of the hyperparasite, a comparison of certain stages to the recent descriptions of Dissanaike (1957) has led to the conclusion that a species of Nosema is probably involved. Several species of Nosema have been reported as hyperparasites of various parasitic helminths. The most recent report is that of Cort, Hussey, and Ameel, (1960).

Stages of Nosema sp. were first seen in this study in the gut of a specimen of I. similis that otherwise appeared normal. These stages closely resembled the sporogony of Nosema helminthorum as reported by Dissanaike. They appeared as small, spherical envelopes containing from two to eight or more spores. Subsequently, it was noted that specimens of I. similis from massive infections nearly all contained various stages of Nosema sp. These were found most often in the gut, but involvement of other structures was also seen. In many specimens the walls of the oesophagus had been completely broken down leaving a large vacuole in the parenchyma in the place where the oesophagus normally occurs. In a few specimens, the pharynx had been partially destroyed by the hyperparasite, and in one specimen the oral sucker had been reduced to a simple funnel-like opening.

Travassos mentioned the involvement of the vitellaria in microsporidian infection. Several specimens in the present group showed

similar vitelline destruction. Quite often the structure of the testes and ovary also appeared to have been affected by the disease organism. In many specimens, the testes appeared as multiple units. These were most often dorso-ventrally situated multiples of the original two testes. This gave the appearance of three or four testes instead of two. This multiplication of testes is probably the result of a weakening of the testicular capsule by the microsporidia, which caused testicular material to flow out into the parenchyma and form additional lobes. In some cases, one or both testes showed internal destruction that left the capsule intact with the contents withdrawn towards the center. In a few examples, the ovary showed a similar internal destruction. A few specimens have been seen in which both testes appeared to be normally encapsulated, but one was very small and the other three times the normal size. This anomaly may possibly be the result of a light infection of Nosema sp. that had inhibited the growth of the testis of one side.

Apparently, Infidum similis has not been reported previously outside of Brazil. The present paper, therefore, represents a considerable range extension for the species. The present report also adds 10 new host species to the host list for a total of 15 known hosts of the parasite. As far as could be determined, I. similis has not been reported from a turtle host prior to this paper.

Family Acanthostomidae Poche, 1926

Subfamily Acanthostominae Nicoll, 1914

Acanthostomum Looss, 1899

The genus Acanthostomum contains some 15 species that are found in tropical and subtropical regions around the world. There are presently 10 known species in the genus from the Americas. Of these, two species have been described from fishes, seven species from crocodilians, and one species from a turtle.

Acanthostomum is easily distinguishable from other trematodes by the presence of a large funnel-shaped oral sucker that bears a single row of large circumoral spines. The pharynx is usually prominent, and a pair of anal apertures is normally present.

Acanthostomum megacetabulum n. sp.

Host: Drymarchon corais melanurus

Site: upper intestinal tract

Geographic range: Tabasco

Illustration: Plate XIII

Specimens of an apparently undescribed species of Acanthostomum were recovered from 5 of the 25 Mexican indigo snakes posted in Tabasco. This form was present in collections from both 1958 and 1959. The largest single infection encountered numbered more than 50 individuals.

The present description is based on studies of 35 stained and cleared specimens, 23 whole mount preparations, and serial sections of 1 specimen. The measurements in the description are of the holotype, followed by the size ranges in parentheses. All measurements are in millimeters.

Description: Acanthostomum megacetabulum has the characteristics of the genus. The body is moderately elongate, cylindrical, and spinous. The body is 2.87 (1.8-3.9) in length by 0.54 (0.39-0.60) in width. The body spination extends to the posterior extremity, but the spines become progressively shorter and more diffuse posteriorly. Individual spines are slightly recurved at the tip, and they attain a maximum length of 0.0104 near the anterior end of the body. The large acetabulum measures 0.195 (0.190-0.204) in diameter.

The oral sucker is funnel-shaped, and it measures 0.318 (0.254-0.318) in diameter by 0.268 (0.268-0.318) in length. The oral aperture is wide, and it is encircled by a single row of large spines. These spines are straight and sharply pointed, and they vary in number from 19 to 21. Each of the circumoral spines measures 0.0695 in length by 0.0174 in lateral width at the base. These spines are deeper at the base in a vertical plane than they are wide in the lateral plane. This greater depth serves for the attachment of musculature to the individual spines. The spines measure 0.0225 in depth at the base. The prepharynx measures 0.089 (0-0.127) in length. The appearance of the prepharynx depends on the state of contraction of a specimen. In some specimens it appears to be non-existent, while in others the prepharynx is moderately long. The barrel-shaped pharynx measures 0.152 (0.14-0.165) in length by 0.127 (0.14-0.127) in width. There is no distinct oesophagus. The gut tapers directly from the pharynx to the bifurcation. The intestinal crura are of variable diameter. They are most often of greater diameter near the bifurcation where they attain a maximum diameter of 0.075. The crura extend to the posterior end of the body where they communicate with the exterior via anal apertures.

These apertures are two in number, and they are situated on either side of the excretory pore.

The testes are in tandem in the posterior one-fifth of the body. They are smoothly spherical. The anterior testis measures 0.19 (0.19-0.23) in length by 0.19 (0.14-0.216) in width. The posterior testis is usually somewhat larger than the anterior one, and it measures 0.216 (0.14-0.254) in length by 0.19 (0.19-0.228) in width. A large, convoluted seminal vesicle is located posterior to the acetabulum, and it communicates with the genital pore by way of an ejaculatory duct. There is no copulatory organ. The genital pore is situated immediately anterior to the acetabulum. Posterior to the acetabulum are numerous glandular cells, but there is no gonotyl.

The smooth, spherical ovary is situated immediately anterior to the anterior testis and is usually contiguous with that structure. The ovary measures 0.19 (0.19-0.203) in length by 0.159 (0.14-0.178) in width. The large seminal receptacle is near the ovary and often overlaps the latter ventrally. The seminal receptacle is 0.216 (0.216-0.28) in length by 0.14 (0.14-0.178) in width. A small Mehlis' gland is located very near the ovary. It is sometimes medial and sometimes anterior to the ovary. The uterus is highly convoluted, and it nearly fills the inter-crural region from the anterior margin of the ovary to the seminal vesicle. The vitelline follicles are dorsal to the crura, and they extend from the equatorial region of the body to about the level of the middle of the anterior testis. Individual vitelline follicles measure from 0.0243 to 0.0695 in diameter. The small, operculate eggs are numerous, and they measure 0.0139-0.0155 x 0.0312-0.033.

The excretory vesicle is Y-shaped, and the branches extend anteriorly to the vicinity of the oral sucker.

Discussion: The present species is believed to be the second one in the genus from a snake. The other is A. burminis (Bhalerao, 1926) from Tropidonotus piscator in Rangoon. The latter species bears little resemblance to present material, and it is considered by some authors to constitute a distinct genus (Skriabin, Vol. X, 1955). A detailed comparison between A. burminis and A. megacetabulum is, therefore, unnecessary.

A. megacetabulum resembles A. caballeroi Pelaez and Cruz, 1953, but it differs from the latter in being smaller, in having a relatively larger acetabulum, and in lacking a gonotyl. Also, the eggs of the new species are larger than those of A. caballeroi.

Table IV Dimensional Comparisons of *Acanthostomum megacetabulum* and *Acanthostomum caballeroi*

		A. megacetabulum	*A. caballeroi* Pelaez and Cruz, 1953
body:	length	1.8-3.9	3.6-7.0
	width	0.39-0.60	0.417-0.767
oral sucker:	length	0.268-0.318	0.232*
	width	0.254-0.318	0.285*
circumoral spines:		19-21	20
	length	0.0695	0.0489-0.0608
	width	0.0174	0.0133-0.0196
pharynx:	length	0.14-0.165	0.061-0.160
	width	0.14-0.127	0.104-0.292
acetabulum:		0.190-0.204	0.133-0.236
ovary:	length	0.19-0.203	0.167-0.285
	width	0.159-0.178	0.137-0.251
eggs:		0.0139-0.0155 x 0.0312-0.033	0.0133-0.0152 x 0.0266-0.0304

*These measurements were not listed in the original description, but were obtained from the redescription by Caballero, 1955. The measurements were of a specimen 5.312 mm. in length.

Acanthostomum scyphocephalum (Braun, 1899)

Hosts: Crocodylus moreletii

Caiman fuscus (Panama)

Testudo matemata (Brazil)

Site: upper intestinal tract

Geographic range: Brazil to Tabasco

Illustration: Plate XIV

This species was originally described from the turtle, Testudo matemata, from Brazil. It has been reported and redescribed from a crocodilian from Panama (Caballero, 1955). Present material consists of three specimens from the crocodile, Crocodylus moreletii.

A. scyphocephalum has a small acetabulum, usually smaller than the pharynx, and a very small gonotyl. The ovary is well separated from the anterior testis, and there are uterine coils between these two organs.

Present material shows the above characters and is therefore assigned to A. scyphocephalum. The present paper adds one species to the list of known hosts of this form.

Family Proterodiplostomidae Dubois, 1936

Subfamily Proterodiplostominae Dubois, 1936

Proterodiplostomum ophidum n. sp.

Host: *Drymarchon corais melanurus*

Site: upper intestinal tract

Geographic range: Tabasco

Illustration: Plate XV

Numerous examples of an apparently undescribed species of holostome trematode were recovered from 9 of the 25 Mexican indigo snakes examined. An additional infection was noted in an 8 foot indigo snake that was brought back from Tabasco and maintained alive in Baton Rouge for five months. The presence of numerous eggs in the faeces of this host indicated a heavy infection which lasted the five months at which time an anthelmintic drug was administered. The drug dislodged a number of the holostome trematodes which confirmed the assumption that they were of the same species. The largest single infection found in Tabasco numbered more than 300 individuals.

Present material consists of about 500 specimens stained and cleared, 20 whole mount slides, and one specimen serially sectioned. Since relatively little size difference occurs in the series, only the measurements of the holotype are given in the description, and these are in millimeters.

Description: *Proterodiplostomum ophidum* has the characteristics of the genus. The body is slender and attenuated. The cuticle is unarmed. The forebody is thin and spatulate while the hindbody is slender and cylindrical. The hindbody is slightly larger than the forebody, but in some specimens the state of contraction of the worm

makes it appear as if the reverse were true. The entire worm measures 4.88 in length. The forebody is 2.24 in length by 0.755 in width. The greatest width of the forebody is at the level of the tribocytic organ. The hindbody is 2.64 in length by 0.34 in diameter.

The small oral sucker has a diameter of 0.073. There is no apparent prepharynx. The pharynx measures 0.076 in length by 0.056 in width. A conical oesophagus of 0.21 in length is present. The intestinal caeca extend to near the posterior extremity of the body, and they are relatively wide. The caeca attain a maximum width of about 0.14 at the level of the tribocytic organ.

The acetabulum is somewhat larger than the oral sucker. It measures 0.11 in diameter, and it is situated slightly posterior to the middle of the forebody. The elliptical tribocytic organ is 0.225 in length by 0.156 in width. It is situated in the center of the posterior third of the forebody. The central aperture of the tribocytic organ is surrounded by about 8 papillae, and a mass of proteolytic glandular cells is situated immediately behind it.

The testes are tandem in the middle of the hindbody. The anterior testis is 0.312 in length by 0.225 in width. The posterior testis is 0.35 in length by 0.230 in width. The vasa efferentia unite near the posterior testis. The vas deferens thus formed expands into a seminal vesicle which proceeds posteriorly in a loosely sinuous path. A short distance from the posterior extremity of the worm, the seminal vesicle narrows to form the ejaculatory duct, which continues to the tip of the genital cone where it opens in conjunction with the opening of the paraprostate gland. The paraprostate gland is an elongate sac-like structure surrounded by glandular cells. It attains a maximum

width of 0.0635, and it extends anteriorly from the tip of the genital cone a distance of 0.56 where it ends blindly. The genital cone protrudes into a prominent genital atrium the aperture of which is subterminal.

The small, ovoid ovary is situated a short distance anterior to the anterior testis. The ovary measures 0.15 in length by 0.11 in width. The oviduct passes posteriorly from the ovary to the ootype and Mehlis' gland, which are located between the testes. The vitelline reservoir and the spherical seminal receptacle are located in the same region. The vitellaria are extensive and quite variable in shape and size. They extend from the region of the acetabulum to near the posterior extremity of the body, and they are dorso-lateral to the intestinal caeca. The uterus leaves the ootype and passes anteriorly to well ahead of the ovary before it loops posteriorly to open into the genital atrium. The eggs in the uterus are large and few in number. The eggs measure 0.059-0.066 x 0.115-0.122.

The excretory pore is dorsally situated at the level of the genital atrium. A short distance anterior to the pore, the excretory system divides to send two main channels forward to the anterior extremity of the body. The main channels lie lateral to the caeca in the forebody. These channels give rise to many lateral branches, which form a flame-like pattern in the forebody.

Discussion: There are presently three other species in the genus Proterodiplostomum. These are; P. longum (Brandes, 1888), P. tumidulum Dubois, 1936, and P. medusae (Dubois, 1936). These three species were all described as parasites of Brazilian crocodilians. The latter two species have also been reported from Panama, and the present paper re-

ports P. tumidulum from Tabasco. The present species is the only one in the genus to be reported from an ophidian host.

P. ophidum differs from the other species in the genus in having a forebody and hindbody of almost equal length. The other species have a hindbody that is considerably longer than the forebody. The tribocytic organ of P. ophidum is much smaller, and the eggs are larger than those of any of the other species.

P. tumidulum is a robust form with a large tribocytic organ, large genital atrium, and slender intestinal caeca. The new species, on the other hand, is quite slender. It has a small tribocytic organ, wide caeca, and the genital atrium is considerably smaller than that of P. tumidulum.

P. longum is a moderately robust form with a very short forebody and a large genital atrium. Hence, it bears little resemblance to the present form.

P. medusae is a slender form, but it has a forebody only about one-third the length of the hindbody. Also, P. medusae has a tribocytic organ that is larger than that of the new species. The tribocytic organ of P. medusae has 10 central papilla in contrast to the 8 papilla of P. ophidum. In the following table of comparisons, it can additionally be seen that P. ophidum has wider caeca, a longer oesophagus, and larger eggs than does P. medusae.

Table V Dimensional Comparisons of *Proterodiplostomum ophidum* and *Proterodiplostomum medusae*

		P. ophidum	*P. medusae**
body:	length	4.88	3.3-3.6
forebody:	length	2.24	0.98-1.13
	width	0.755	0.498
hindbody:	length	2.64	2.41-2.51
	width	0.34	0.23-0.27
oral sucker:	diameter	0.073	0.057-0.072
oesophagus:	length	0.21	0.004-0.038
caeca:	width	0.14	0.008-0.034
tribocytic organ:	length	0.225	0.266-0.308
acetabulum:	diameter	0.11	0.049-0.084
ovary:	length	0.15	0.095-0.114
	width	0.11	0.122
anterior testis:	length	0.312	0.163-0.209
	width	0.225	0.194-0.209
posterior testis:	length	0.35	0.209-0.220
	width	0.236	0.190-0.198
eggs:		0.059-0.066 x 0.115-0.122	0.061-0.068 x 0.103-0.115

*measurements taken from Caballero, Hidalgo, and Grocott, 1957

Proterodiplostomum tumidulum Dubois, 1936

Hosts: *Crocodylus moreletii*

Caiman crocodilus (Brazil)

Caiman fuscus (Panama)

Site: lower intestinal tract

Geographic range: Brazil to Tabasco

Dubois described this species from Brazilian material, and Caballero, Hidalgo, and Grocott, 1957, reported and redescribed it from Panama. On April 17, 1959, a specimen of *Crocodylus moreletii*, which measured 192 cm. in over-all length, was examined in Tabasco. It was found to contain three species of holostome trematodes, including 45 specimens of *Massoprostatum longum* Caballero, 1947, 80 specimens of *Crocodilicola pseudostoma* (Willemoes-Sum, 1870), and 4 specimens of *Proterodiplostomum tumidulum*.

The 4 specimens of *P. tumidulum* have been assigned to the species on the basis of the prominent paraprostate gland, the large genital atrium, and the large papillose tribocytic organ. Other aspects of the morphology of this form closely compare to the redescription of Caballero, Hidalgo, and Grocott. Specimens in the present series are larger than the maximum given by those authors, however. Present material reaches a maximum of 4.6 mm. while the above authors list 2.87 as the greatest length. The egg size of the specimens from Tabasco falls within the size range given for the species.

This is the first report of the species for Mexico, and it adds one new host to the list. Tabasco is probably near the northernmost limit of the range of this neotropical species.

Subfamily Ophiodiplostominae Dubois, 1936

Herpetodiplostomum delillei Zerecero, 1947

Hosts: Chelydra serpentina

Claudius angustatus

Site: upper intestinal tract

Geographic range: Veracruz and Tabasco

Illustration: Plate XVI

This species was originally described from material collected at Alvarado, Veracruz, from Chelydra serpentina. The two specimens of C. serpentina examined in Tabasco were found to harbor infections of the same species. Additionally, two mature specimens of H. delillei were recovered from Claudius angustatus. Immature trematodes believed to belong to the same species have also been recovered from the intestinal tract of Natrix rhombifera werleri. In all, some 45 specimens of this species have been stained and studied.

Present material compares quite closely to the description of this species published by Zerecero. Some specimens in the series reach 3.75 mm. in length, however, as compared to a maximum of 3.39 as listed in the original description. The present paper extends the known range of the species to Tabasco, and adds an additional host.

Subfamily Massoprostatinae Yamaguti, 1958

Massoprostatum longum Caballero, 1947

Host: Crocodylus moreletii

Site: upper intestinal tract

Geographic range: Veracruz and Tabasco

Illustration: Plate XVII

This highly attenuate trematode was described from the same host species taken from the Cuetzalapan River near Catemaco, Veracruz. Present material consists of 52 specimens taken from 4 of the 6 crocodiles examined. The only morphological detail that can presently be added to the original description is in the matter of size range. The size range given by Caballero was 10.072-10.544 mm. in length. Mature individuals in the present series range in length from 8.3 to 17.9 mm. The present paper is believed to be the first report of the species in Tabasco.

Subfamily Polycotylinae Monticelli, 1888

Crocodilicola pseudostoma (Willemoes-Sum, 1870)

Hosts: *Crocodylus moreletii*

Alligator mississippiensis (U.S.A.)

Site: upper intestinal tract

Geographic range: South Carolina to Veracruz and Tabasco

Numerous specimens of this species were collected from 5 of the 6 crocodiles examined. The largest single infection numbered 80 individuals. *C. pseudostoma* can be distinguished from the other holostomes that are discussed in the present paper by the following characteristics. The forebody is much longer than the hindbody. The tribocytic organ is large and papillose. The vitellaria are confined to the forebody between the acetabulum and the posterior margin of the tribocytic organ. A paraprostate and genital cone are present.

Byrd and Reiber, 1942, have reported *C. pseudostoma* from the southern United States in the alligator. Caballero, 1948, reported the species in a specimen of *Crocodylus moreletii* that came from the

Cuetzalapan River, Catemaco, Veracruz. The present paper extends the known range of this apparently nearctic form south to Tabasco.

Family Clinostomidae Luehe, 1909

Subfamily Clinostominae Pratt, 1902

Clinostomum marginatum (Rudolphi, 1819)

Host: *Natrix rhombifera werleri*

Site: intestinal tract

Geographic range: North and South America, and Cuba

During 1958, a single specimen of *Natrix rhombifera werleri* was found that contained 10 large trematodes in the lower portion of the intestinal tract. Although immature, these worms measured 10 mm. in length by 3 mm. in width. The worms were alive, but they were entwined in a faecal mass as though about to pass from the snake. In 1959, a single smaller specimen of the same trematode was found in the same host, and it appeared to be living successfully in the upper intestinal tract. These 11 worms were subsequently studied and found to belong to *Clinostomum* Leidy, 1856. In the key to the species of the genus by Price (1938), all of the present specimens are identifiable as *C. marginatum*, or else they key out to species that have been placed in synonymy with the latter.

C. marginatum is a widespread trematode found all over the Western Hemisphere. It matures in herons and similar birds. The metacercarial stage is known to occur in fish and frogs. There can be little doubt, therefore, that the occurrence of *C. marginatum* in the watersnake in Tabasco is accidental, and a result of the snakes having eaten fish that contained well-developed metacercariae.

Family Pronocephalidae Looss, 1899

Subfamily Choanophorinae Caballero, 1942

Choanophorus rovirosai Caballero, 1942

Host: *Dermatemys mawii*

Site: lower intestinal tract

Geographic range: Veracruz and Tabasco

Illustration: Plate XVIII

Caballero, 1942, described this species from a river turtle, *Dermatemys mawii*, that had been taken at Tlacotalpan, Veracruz. Present material consists of 12 specimens collected from a single host of the same species on February 27, 1959, in Tabasco. Mature specimens in the series range from 2.5 to 6.6 mm. in length. No range of sizes is given in the original description, but the length of the holotype is listed as 6.858 mm.

This monostome trematode is quite distinct in several respects, and there can be no doubt that present material is conspecific with that of Caballero. *C. rovirosai* has a large median cuticular pouch surrounding the genital apertures. The head collar is rudimentary as compared with other pronocephalids. The posterior extremity has infundibular invaginations that extend to near the ends of the caeca. The eggs have a slender filament projecting from each end.

A study of the present series has not revealed any important morphological detail that is not included in the original description. As far as can be determined, the present paper constitutes the second record of the species, and the first report of it for the state of Tabasco.

Family Heronimidae Ward, 1917

Heronimus chelydrae MacCallum, 1902

Hosts (Mexico):

Kinosternon leucostomum

Kinosternon hirtipes

Claudius angustatus

Hosts (United States):

Chelydra serpentina

Emys blandingi

Graptemys geographica

Kinosternon subrubrum

Pseudemys scripta

Sternotherus odoratus

Host (Panama):

Kinosternon panamensis

Site: lungs

Geographic range: United States to Panama

MacCallum, 1902, described *H. chelydrae* from the snapping turtle, *Chelydra serpentina* from the United States. In 1921, he described two more forms from American turtles, which he called *H. geomydae* and *H. maternum*. In 1940 Caballero encountered specimens of *Heronimus* in the lungs of *Kinosternon hirtipes* from the Mexican states of Michoacan and Guanajuato. In determining his material, Caballero compared it with MacCallum's type material. He found the main difference in the various forms to be the length of the tubular testes. From the total series, it was apparent to him that the testes in older worms shorten by degeneration. He therefore concluded that MacCallum had described the same

species under three different names. Caballero placed the other names in synonymy with H. chelydrae, and he assigned his own material to that species.

Present material consists of about 35 specimens. This species was encountered in half of the 24 specimens of Kinosternon leucostomum examined, and in 9 out of 20 of the specimens of Claudius angustatus. Present material undoubtedly belongs to the one valid species of Heronimus. It is believed that this represents the first report of the species for Tabasco, and C. angustatus is a new host record.

Rosales, 1951, reported H. chelydrae at Alvarado, Veracruz in Kinosternon leucostomum. More recently, Caballero, Zerecero, and Grocott, 1958, have reported the species from K. panamensis taken on the Curundu River in Panama.

HOST-PARASITE LIST

Introduction: In the following host-parasite list, the scientific names of the host species have been arranged alphabetically under the headings Lizards, Snakes, Crocodiles, and Turtles. Immediately after the technical name, a number can be found enclosed in parentheses, which indicates the number of individuals examined. The common names, where these exist and are known, are listed after the number. Local or Spanish names precede the English common names.

Below the scientific name of each host, the names of the trematode parasites from that host are listed. The number of hosts positive for a particular parasite is listed in parentheses immediately after the name of that parasite. Following the number of hosts positive, the percentage positive is listed.

At the end of the host-parasite list, a tabulation is presented to show the totals of host species in the various categories.

LIZARDS

Ameiva undulata amphigramma Smith and Laufe (19) Lagartija;

Mesocoelium travassosi Pereira and Cuocolo, 1940, (3) 15%

Anolis humilis uniformis Cope (2)

negative

Basiliscus vittatus Wiegmann (28) Toloque; Basilisque lizard

Parahaplometroides basiliscae n. gen. and n. sp. (16) 57%

Parallopharynx arctus Caballero, 1946 (10) 36%

Iguana iguana rhinolopha Wiegmann (21) Garobo, Iguana; Iguana

negative

Lepidophyma flavimaculatum Dumeril (4)

negative

Mabuya brachypoda Taylor (4) Lagartija;

Mesocoelium travassosi Pereira and Cuocolo, 1940 (1) 25%

Sceloporus teapensis Gunther (13) Lagartija; Fence lizard, Swift

negative

Sphaerodactylus glaucus glaucus Cope (2) Guarda casa; Gecko

negative

SNAKES

Bothrops atrox aspera (Garman) (20) Nauyaca; Fer d'lance

Ochetosoma ellipticum (Pratt, 1903) (19) 95%

Styphlodora horrida (Leidy, 1850) (6) 30%

Infidum similis Travassos, 1916 (3) 15%

Clelia clelia clelia Duadin (2) Masacua;

Ochetosoma ellipticum (Pratt, 1903) (2) 100%

Infidum similis Travassos, 1916 (2) 100%

Coniophanes bipunctatus biseriatus Smith (10)

Catadiscus marinholutzi Freitas and Lent, 1939 (9) 90%

Ochetosoma ellipticum (Pratt, 1903) (5) 50%

Infidum similis Travassos, 1916 (1) 10%

Coniophanes imperialis clavatus (Peters) (32) Oracionera;

Catadiscus marinholutzi Freitas and Lent, 1939 (3) 9%

Glypthelmins proximus Freitas, 1941 (1) 3%

Ochetosoma ellipticum (Pratt, 1903) (12) 36%

Coniophanes quinquevittatus (Dumeril, Bibron, and Dumeril) (4)

Catadiscus marinholutzi Freitas and Lent, 1939 (1) 25%

Ochetosoma ellipticum (Pratt, 1903) (1) 25%

Styphlodora horrida (Leidy, 1850) (2) 50%

Opisthogonimus tabascensis n. sp. (1) 25%

Infidum similis Travassos, 1916 (3) 75%

Constrictor constrictor imperator Duadin (16) Sauyan; Boa constrictor

Telorchis pseudoaculeatus Dollfus, 1929 (1) 6%

Styphlodora horrida (Leidy, 1850) (6) 38%

Dryadophis melanolomus veraecrucis Stuart (1) Cola de fuego;

Ochetosoma ellipticum (Pratt, 1903) (1) 100%

Styphlodora horrida (Leidy, 1850) (1) 100%

Drymarchon corais melanurus (Dumeril, Bibron, and Dumeril) (25) Mocoche;

Mexican indigo snake

Ochetosoma ellipticum (Pratt, 1903) (23) 92%

Styphlodora horrida (Leidy, 1850) (9) 36%

Infidum similis Travassos, 1916 (24) 96%

Acanthostomum megacetabulum n. sp. (5) 20%

Proterodiplostomum ophidum n. sp. (9) 36%

Drymobius margaritiferus margaritiferus (Schlegel) (21) Bejuquilla;

Ochetosoma ellipticum (Pratt, 1903) (17) 80%

Mesocoelium travassosi Pereira and Cuocolo, 1940 (1) 5%

Imantodes cenchoa leucomelas Cope (1)

negative

Lampropeltis triangulum polyzona Cope (12) Coral; Milk snake

Styphlodora horrida (Leidy, 1850) (4) 33%

Leptodeira septentrionalis polysticta Gunther (7) Guanera;

Catadiscus marinholutzi Freitas and Lent, 1939 (1) 14%

Ochetosoma ellipticum (Pratt, 1903) (3) 43%

Infidum similis Travassos, 1916 (1) 14%

Leptophis mexicana mexicana (Dumeril, Bibron, and Dumeril) (30) Bejuquilla;

Ochetosoma ellipticum (Pratt, 1903) (27) 90%

Mesocoelium travassosi Pereira and Cuocolo, 1940 (1) 3%

Leptophis occidentalis praestans (Cope) (3) Lora;

Glypthelmins proximus Freitas, 1941 (1) 33%

Ochetosoma ellipticum (Pratt, 1903) (3) 100%

Telorchis corti (Stunkard, 1915) (1) 33%

Infidum similis Travassos, 1916 (1) 33%

Micrurus affinis alienus (Werner) (2) Coral candil; Coral snake

Ochetosoma ellipticum (Pratt, 1903) (2) 100%

Infidum similis Travassos, 1916 (2) 100%

Natrix rhombifera werleri Conant (31) Nauyaca de agua; water snake

Telorchis pseudoaculeatus Dollfus, 1929 (7) 23%

Styphlodora horrida (Leidy, 1850) (4) 13%

Infidum similis Travassos, 1916 (1) 3%

Herpetodiplostomum delillei Zerecero, 1947 (metacercariae) (4) 13%

Clinostomum marginatum (Rudolphi, 1819) (metacercariae) (2) 6%

Ninia sebae sebae (Dumeril, Bibron, and Dumeril) (14) Coralito de tierra;

Telorchis pseudoaculeatus Dollfus, 1929 (1) 7%

Mesocoelium travassosi Pereira and Cuocolo, 1940 (8) 57%

Oxybelis aeneus auratus Bell (2)

negative

Pliocercus elapoides elapoides Cope (1)

Ochetosoma ellipticum (Pratt, 1903) (1) 100%

Spilotes pullatus mexicanus (Laurenti) (12) Icoteera; Tropical rat snake

Styphlodora horrida (Leidy, 1850) (8) 66%

Thamnophis sauritus chalceus (Cope) (45) Bejuquilla de agua; Garter snake

Catadiscus marinholutzi Freitas and Lent, 1939 (1) 2%

Glypthelmins proximus Freitas 1941 (3) 6%

Ochetosoma ellipticum (Pratt, 1903) (11) 26%

Styphlodora horrida (Leidy, 1850) (1) 2%

Infidum similis Travassos, 1916 (2) 4%

Tretanorhinus nigroluteus lateralis Bocourt (3)

negative

Tropidodipsas sartori sartori Cope (1)

negative

CROCODILES

Crocodylus moreletii Dumeril and Bibron (6) Lagarto; crocodile

Acanthostomum scyphocephalum (Braun, 1899) (1) 16%

Proterodiplostomum tumidulum Dubois, 1936 (2) 33%

Massoprostatum longum Caballero, 1947 (4) 66%

Crocodilicola pseudostoma (Willemoes-Suhm, 1870) (5) 83%

TURTLES

Chelydra serpentina (Linnaeus) (2) Chiquiguao; Common Snapping Turtle

Neopolystoma domitilae (Caballero, 1938) (1) 50%

Telorchis corti (Stunkard, 1915) (1) 50%

Herpetodiplostomum delillei Zerecero, 1947 (2) 100%

Claudius angustatus Cope (20) Taimami;

Telorchis corti Stunkard, 1915 (4) 20%

Telorchis patonianus (Caballero, 1935) (5) 25%

Heronimus chelydrae MacCallum, 1902 (7) 35%

Herpetodiplostomum delillei Zerecero, 1947 (1) 5%

Dermatemys mawii Gray (2) Tortuga;

Dadaytrema sphaerorchidum n. sp. (2) 100%

Dermatemytrema trifoliatum Price, 1937 (1) 50%

Schizamphistomoides resupinatum Caballero, 1940 (2) 100%

Schizamphistomoides tabascense Caballero and Sokoloff, 1934 (2) 100%

Octangioides tlacotalpensis Caballero, 1942 (2) 100%

Choanophorus rovirosai Caballero, 1942 (1) 50%

Geomyda areolata (Dumeril and Bibron) (1) Mojina;

negative

Kinosternon leucostomum Dumeril (24) Pochitoque;

Schizamphistomoides tabascense Caballero and Sokoloff, 1934 (1) 4%

Telorchis corti (Stunkard, 1915) (1) 4%

Heronimus chelydrae MacCallum, 1902 (12) 50%

Pseudemys scripta ornata (Gray) (22) Icotea;

Polystomoides coronatus (Leidy, 1888) (1) 4%

Neopolystoma domitilae (Caballero, 1938) (2) 9%

Schizamphistomoides tabascense Caballero and Sokoloff, 1934 (17) 77%

Telorchis corti (Stunkard, 1915) (11) 50%

Staurotypus triporeatus Wiegmann (10) Guao;

Telorchis patonianus (Caballero, 1934) (4) 40%

Infidum similis Travassos, 1916 (1) 10%

	Number of Species	Number of Specimens
Lizards	8	93
Snakes	23	295
Crocodiles	1	6
Turtles	7	81
	39	475

ANALYSIS OF FAUNAL COMPONENTS

Many of the trematode species encountered early in the present study were either the same as, or similar to, species previously reported from Brazil. A number of others were known from the United States but not from South America. These findings suggested that Tabasco might be a region of overlap between nearctic and neotropical trematode faunas. Caballero, who has recorded a number of reptilian trematodes from the state of Veracruz and one from Tabasco, has remarked on this phenomenon. In a paper published in 1948 he stated: "Crocodilicola pseudostoma (Willemoes-Sum, 1870) es la unica especie asignada al genero hasta la fecha. G. Dubois y otros investigadores la situan en la zona Neartica y con dudas en la Neotropical, al mencionar al Brasil como distribucion geografica. Con el hallazgo de los ejemplares que hemos descrito ahora, definitivamente C. pseudostoma queda tambien situada en la zona Neotropical pues la localidad en que hemos encontrado al huesped, Crocodylus moreletii, pertenece a la mencionada zona. Constantemente, durante nuestros estudios de la fauna helmintologica de Mexico, hemos encontrado una emigracion de formas Nearticas hacia la Neotropical y viceversa; por este hecho tiene un gran interes el estudio cientifico de la fauna del sureste de nuestro pais, pues es ahi en donde se hace el entrecruzamiento de formas pertenecientes a las dos zonas."

The present analysis attempts to examine the extent of this faunal

overlap. The nearctic and neotropical trematode faunas are not sufficiently well known to permit a definitive analysis, however.

The species considered in the present study are listed below according to their presently known distribution. The present distribution of these forms suggests their possible geographic origin.

Neotropical trematodes of probable South American origin

Catadiscus marinholutzi

Dadaytrema sphaerorchidum

Glypthelmins proximus

Styphlodora horrida

Opisthogonimus tabascensis

Mesocoelium travassosi

Infidum similis

Acanthostomum scyphocephalum

Proterodiplostomum ophidum

Proterodiplostomum tumidulum

Neotropical trematodes known only from Southern Mexico or Central America

Neopolystoma domitilae

Schizamphistomoides resupinatum

Schizamphistomoides tabascense

Dermatemytrema trifoliatum

Octangioides tlacotalpensis

Parahaplometroides basiliscae

Parallopharynx arctus

Telorchis patonianus

Acanthostomum megacetabulum

Herpetodiplostomum delillei

Massoprostatum longum

Choanophorus rovirosai

Nearctic trematodes

Polystomoides coronatus

Ochetosoma ellipticum

Telorchis corti

Telorchis pseudoaculeatus

Crocodilicola pseudostoma

Heronimus chelydrae

Twelve species are listed that may be regarded as indigenous to southern Mexico or Central America. An additional 10 species are of probable South American origin, and 6 species show a distribution from the United States southward to Tabasco.

Three of the herein described new species are included with the South American group of species because the genera concerned are almost exclusively South American. The known species in the genera *Catadiscus*, *Dadaytrema*, *Opisthogonimus*, *Infidum* and *Proterodiplostomum* are almost entirely South American in distribution. In contrast, representatives of the genera *Glypthelmins*, *Styphlodora*, *Mesocoelium*, and *Acanthostomum* are found throughout most of the world.

The distribution of the definitive host species is of considerable importance in considering the origin of the reptilian trematode fauna of Tabasco. For this reason the following listing of host species has been prepared. The complete ranges of these hosts are not included,

but 9 of the presently considered hosts are known from both Brazil and southern Mexico. Of the 9, only Drymarchon corais commonly reaches the southern United States. An additional 6 host species are known from the United States and Tabasco, but do not range to Brazil. The remainder of the species in the host list are of more limited distribution.

Neotropical reptiles (ranging from Brazil to Tabasco)

Bothrops atrox

Clelia clelia

Constrictor constrictor

Drymarchon corais

Imantodes cenchoa

Leptophis occidentalis

Oxybelis aenues

Spilotes pullatus

Iguana iguana

Nearctic reptiles (ranging from U. S. A. to Tabasco)

Lampropeltis triangulum

Micrurus affinis

Natrix rhombifera

Thamnophis sauritus

Pseudemys scripta

Chelydra serpentina

The presence of a trematode in a particular region depends not only on a suitable definitive host, but also on the presence of suitable intermediate hosts. Present knowledge of trematode life-cycles is insufficient to explain precisely the absence of certain elements

from the fauna of Tabasco. As an example, the typical ophidian lung inhabiting plagiorchiids (Pneumatophilus, Lechriorchis, etc.), which are common in the United States, are strikingly absent from the snakes of Tabasco. This is true in spite of the fact that Natrix rhombifera and Thamnophis sauritus, which are hosts to these forms in the United States, both range to Tabasco. In a case of this kind, the probable limiting factor to the distribution of the trematodes would be the lack of suitable molluscan intermediate hosts.

Conversely, the spread of a trematode geographically must depend on transportation by its active vertebrate host and on the presence of suitable intermediate hosts in any new region. A particularly illuminating example may be seen in the indigo snake, Drymarchon corais. This host ranges from South America to the southern part of the United States. Hence, the indigo snake is a snake of tropical and semitropical habitats. Infidum similis is one of the trematode parasites of the indigo snake in Brazil. The present study has shown the same trematode to be common in Tabasco, but it has not been reported from northern Mexico or the United States. Drymarchon corais appears to be the principle host of I. similis in Tabasco. In all probability the trematode was brought northward as its host succeeded in spreading its range northward. I. similis has found suitable intermediate hosts in Tabasco, and has been able to colonize ophidian hosts that have a more limited distribution than does the indigo snake. The northward spread of this trematode is probably controlled by the lack of suitable intermediate hosts in the northern portions of the range of the indigo snake. It is of interest to note that not only do the indigo snakes of Brazil and Tabasco share the same species of Infidum, but these trematodes, from both regions, have been

shown to have similar microsporidian hyperparasites.

Probable causes for the mixed reptilian trematode fauna of Tabasco become apparent if a comparison is made between the trematode and host distributions. For example, the presence of Pseudemys scripta in Tabasco explains the presence of Polystomoides coronatus as no intermediate host is necessary. Similarly, the origin of Ochetosoma ellipticum in the fauna of Tabasco was probably dependent on the arrival of Thamnophis sauritus from more northern regions. In the same manner, Pseudemys scripta has probably served as a transport host for Telorchis corti, and Natrix rhombifera may have served to transport Telorchis pseudoaculeatus.

Among the trematodes that range from Brazil to Tabasco, there can be seen several examples of species whose ranges are paralleled by the ranges of their principle hosts. Notable in this regard is the case of Styphlodora horrida and its principle host snake, Spilotes pullatus. The trematodes Catadiscus marinholutzi, Glypthelmins proximus, and Mesocoelium travassosi are of amphibian origin. These three species probably reached Tabasco by means of widely distributed South American frogs.

Tabasco is a region that has three distinct components in its reptilian trematode fauna. This trematode fauna bears considerably more resemblance to the fauna of Brazil than it does to the fauna of northern Mexico or the United States. A sizeable element in the fauna is not known to occur outside of the Central American region. These forms may be regarded as indigenous, and some of them probably evolved in the region. For example, the several amphistomes of the river turtle, Dermatemys mawii, are likely in this category.

SUMMARY AND CONCLUSIONS

The findings of a study on the trematodes of reptiles from central Tabasco, Mexico, have been presented. A total of 475 reptile hosts of 39 species were examined. The 39 species of hosts included 8 species of lizards, 23 species of snakes, 1 species of crocodile, and 7 species of turtles.

In all, 29 species of trematode, belonging to 11 families and 21 subfamilies, have been recovered and studied. Of these, 5 forms are herein described and named for the first time. One of these new species has been regarded as distinct enough to necessitate the erection of a new genus. The newly described forms are: Dadaytrema sphaerorchidum n. sp. (Paramphistomidae) from Dermatemys mawii; Parahaplometroides basiliscae n. gen. and n. sp. (Plagiorchiidae) from Basiliscus vittatus; Opisthogonimus tabascensis n. sp. (Plagiorchiidae) from Coniophanes quinquevittatus; and Acanthostomum megacetabulum n. sp. (Acanthostomidae), and Proterodiplostomum ophidum n. sp. (Proterodiplostomidae) both from Drymarchon corais melanurus.

Of the 29 trematode species presently recorded for Tabasco, only one, Schizamphistomoides tabascense, is known to have been reported previously for the state. Consequently, the other 28 species represent new locality records. Some 58 new host records are also presented. Additionally, it has been possible to study large numbers of some species by mass staining techniques. A considerable amount of new information

has thus come to light on the morphology and intraspecific variation of certain forms. This has led to the redescription of Parallopharynx arctus and the emendation of the generic diagnosis. Catadiscus marinholutzi is also redescribed.

An examination of the presently reported reptilian trematode fauna, has indicated the presence of three components. The fauna may be regarded as 43 percent Central American, 36 percent South American, and 21 percent North American. It may therefore be concluded that Tabasco represents a zone of overlap where wide-ranging neotropical and nearctic forms coincide. The reptilian trematode fauna of Tabasco shows more similarity to the fauna of Brazil than it does to that of northern Mexico or the United States.

PLATE I Paramphistomidae; *Cotadiscus marinholutzi* Freitas and Lent, 1939, ventral view

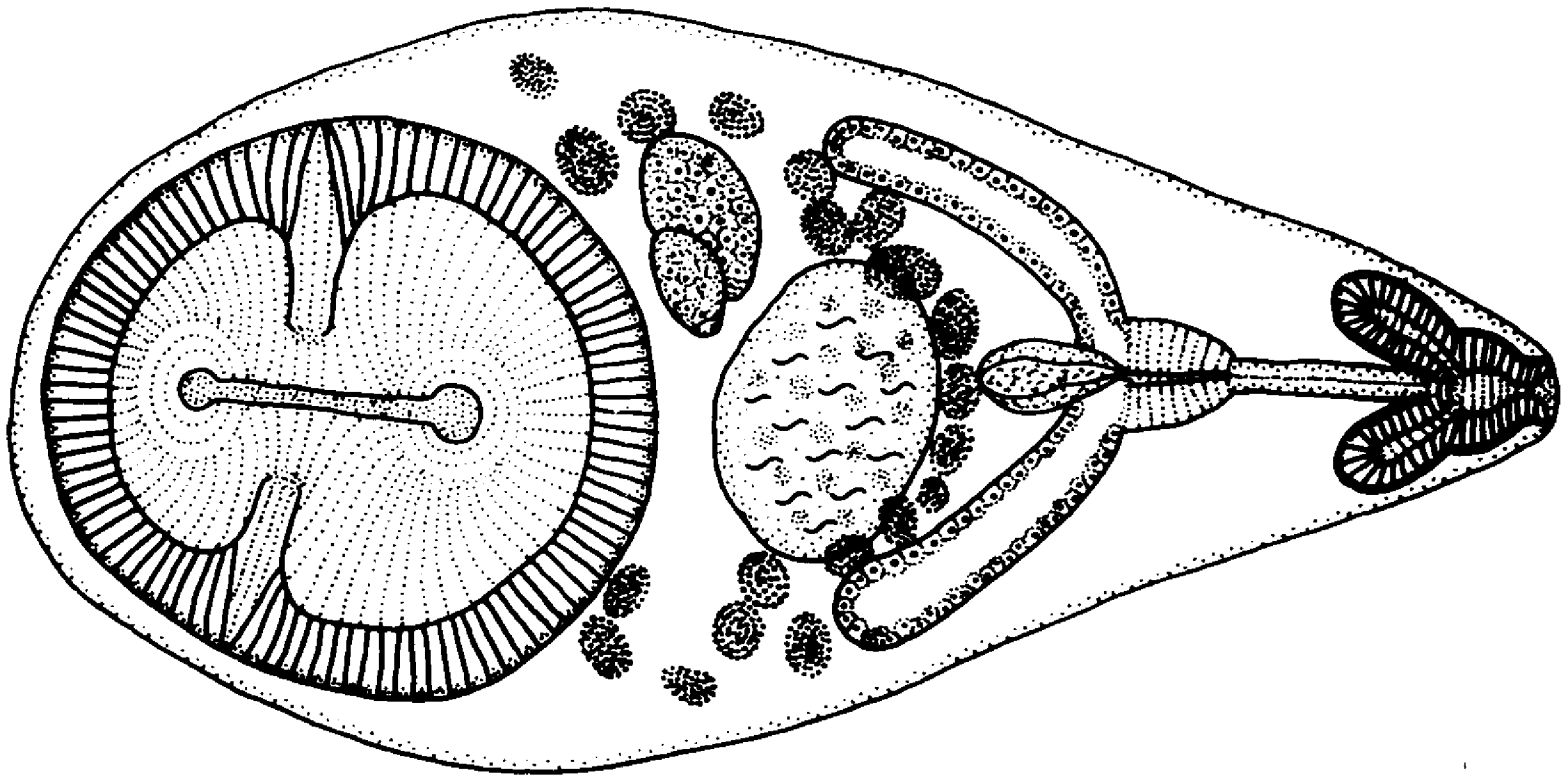
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PLATE II Paramphistomidae; Dadaytrema sphaerorchidum

ventral view

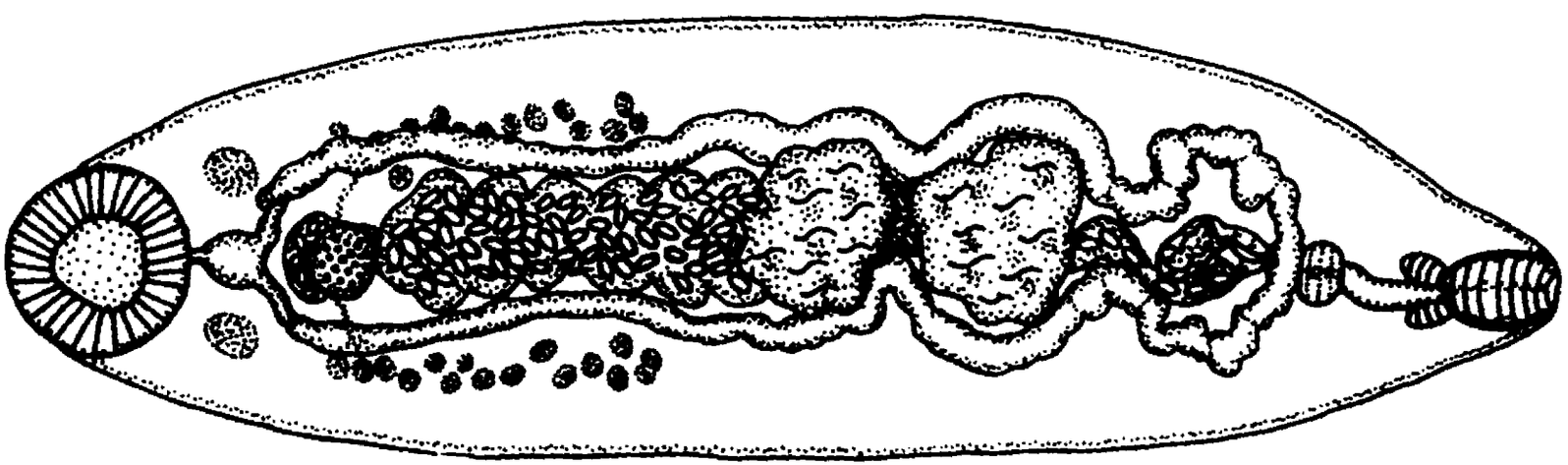

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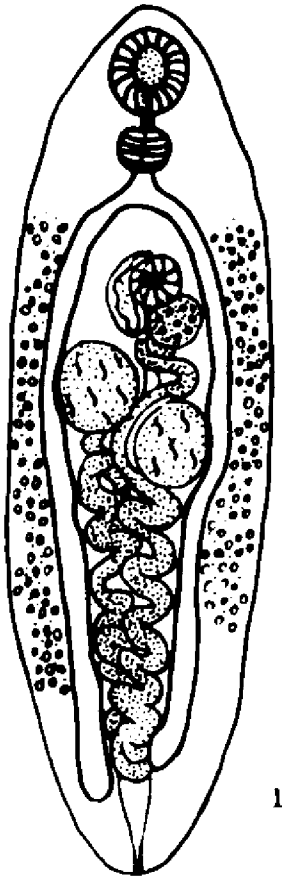
PLATE III Plagiochiidae; *Glypthelmins proximus* Freitas, 1941, ventral aspect, to show intraspecific variation

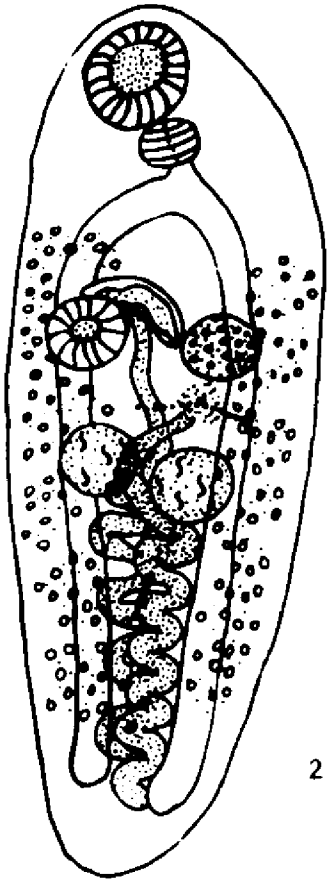
Figure 1, from *Thamnophis sauritus*

Figure 2, from *Coniophanes imperialis*

Figure 3, from *Leptophis occidentalis*



1



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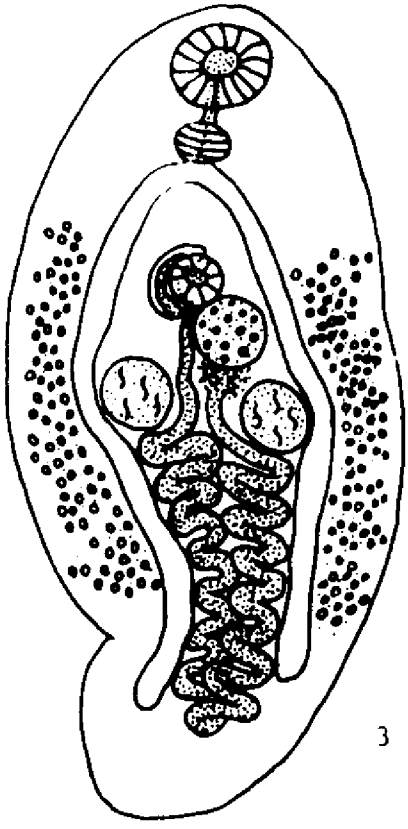

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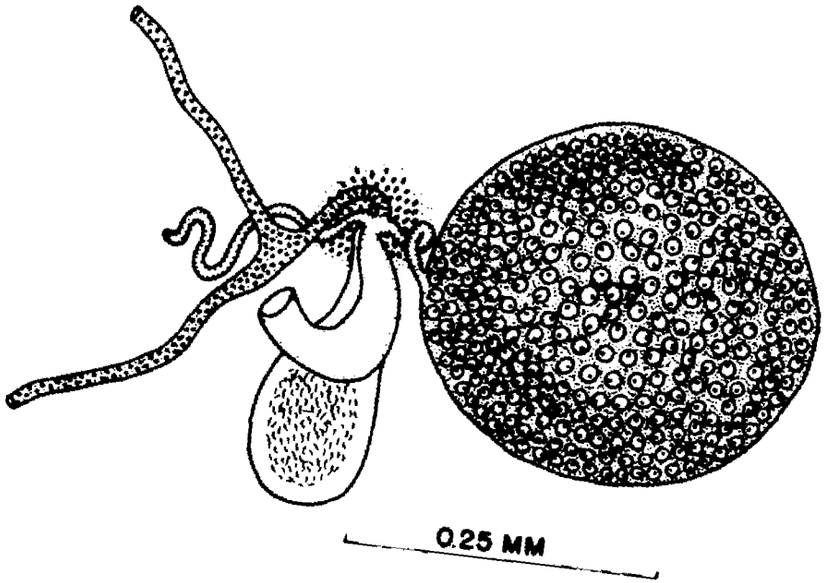
PLATE IV Plagiorchiidae; Parallopharynx arctus

Caballero, 1946

morphology; oral lappets, ovarian complex, and cirrus sac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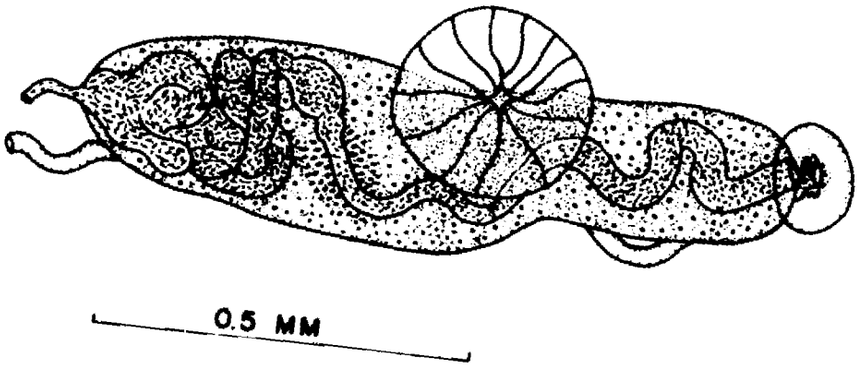
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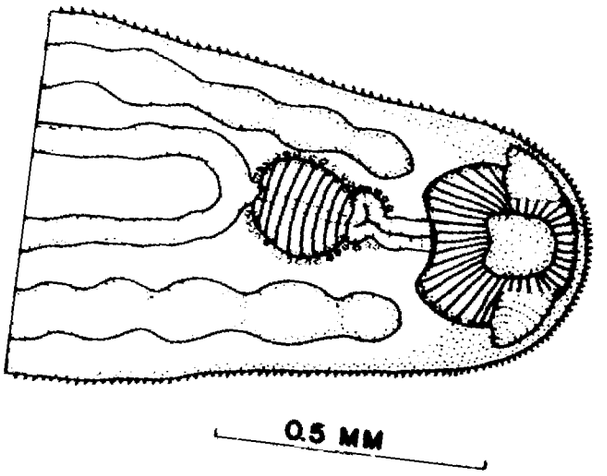
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PLATE V Plagiorchiidae; *Parallopharynx arctus* Caballero, 1946; intraspecific variation in distribution of vitellaria

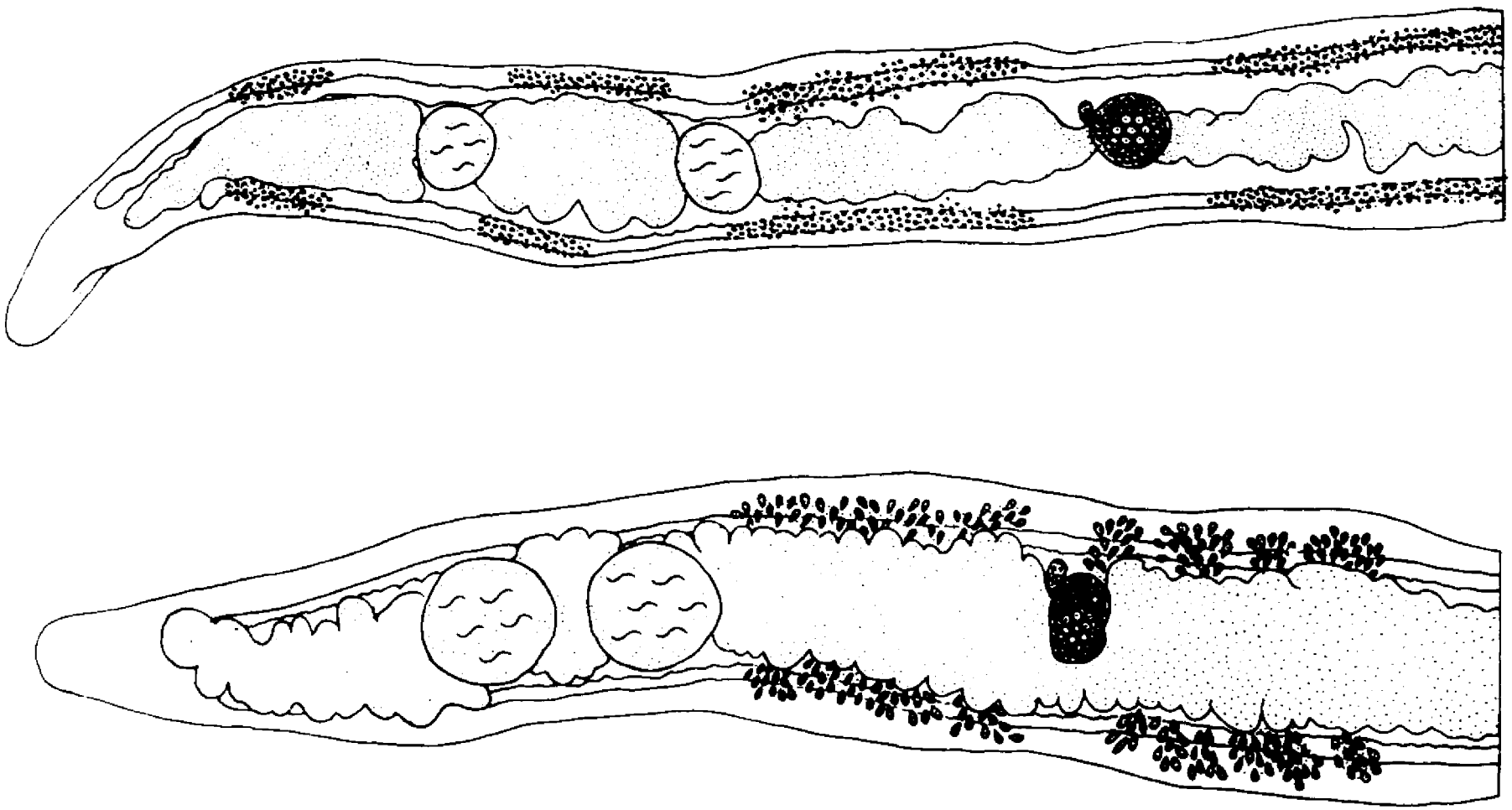
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PLATE VI Plagiorchiidae; *Opisthogonimus tabascensis*

ventral view

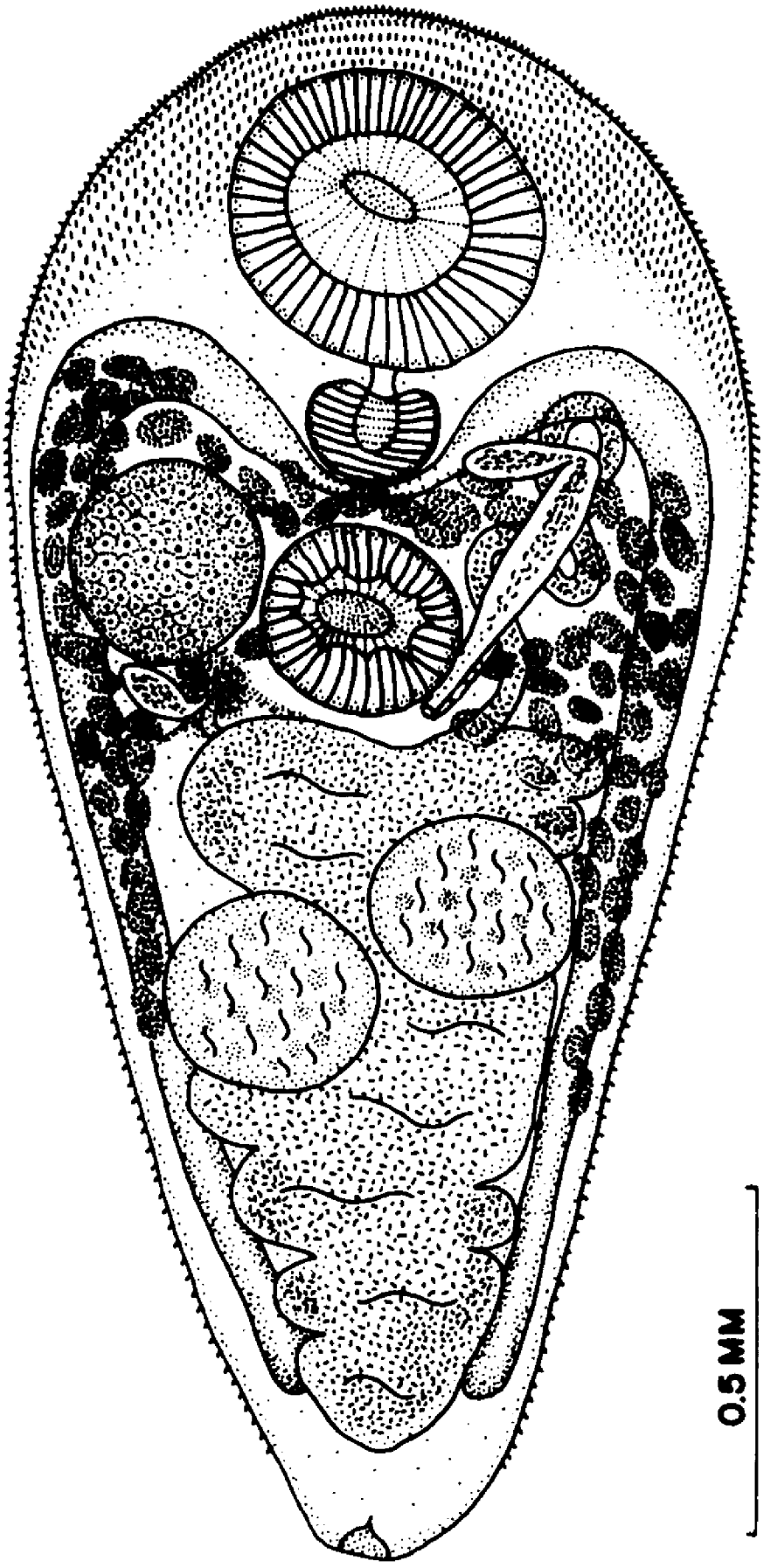
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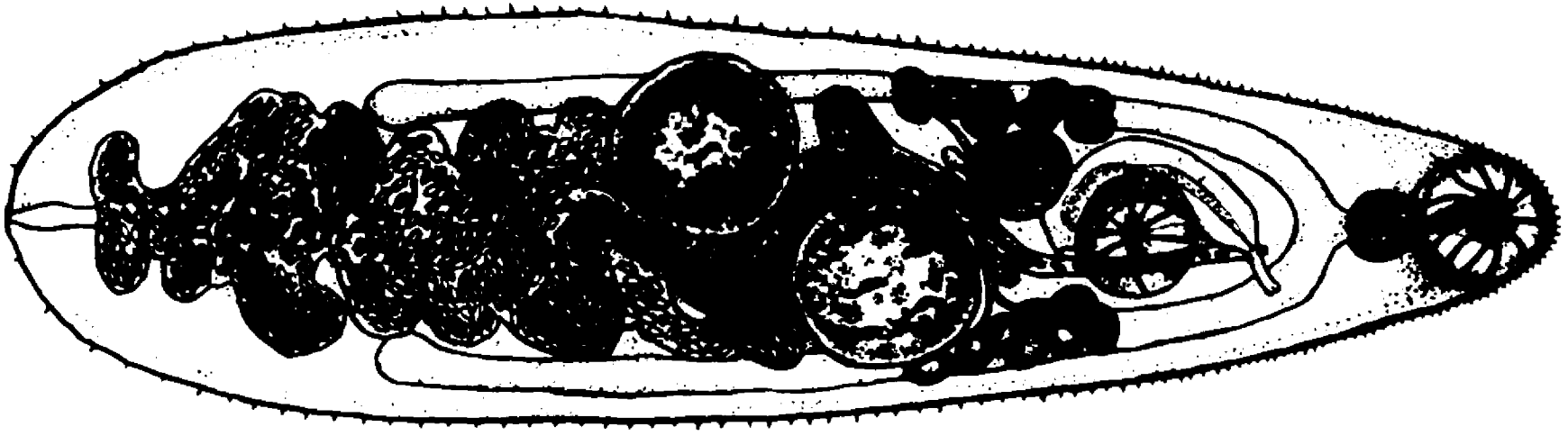
PLATE VII Plagiorchiidae; Styphlodora horrida (Leidy, 1850) ventral view



1.0 MM

PLATE VIII Plagiorchiidae; Parahaplometroides basiliscae

ventral view

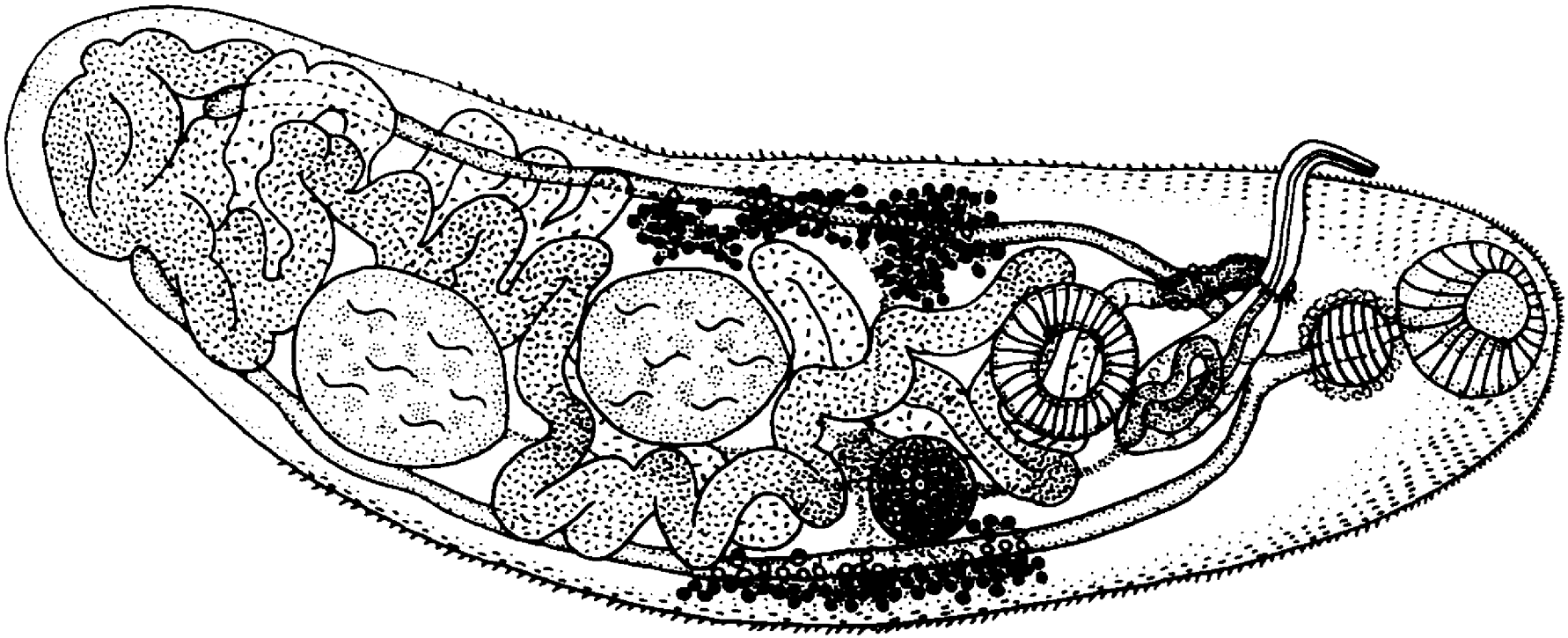

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PLATE IX Brachycoeliidae; *Mesocoelium travassosi*

Pereira and Cuocolo, 1940, ventral view

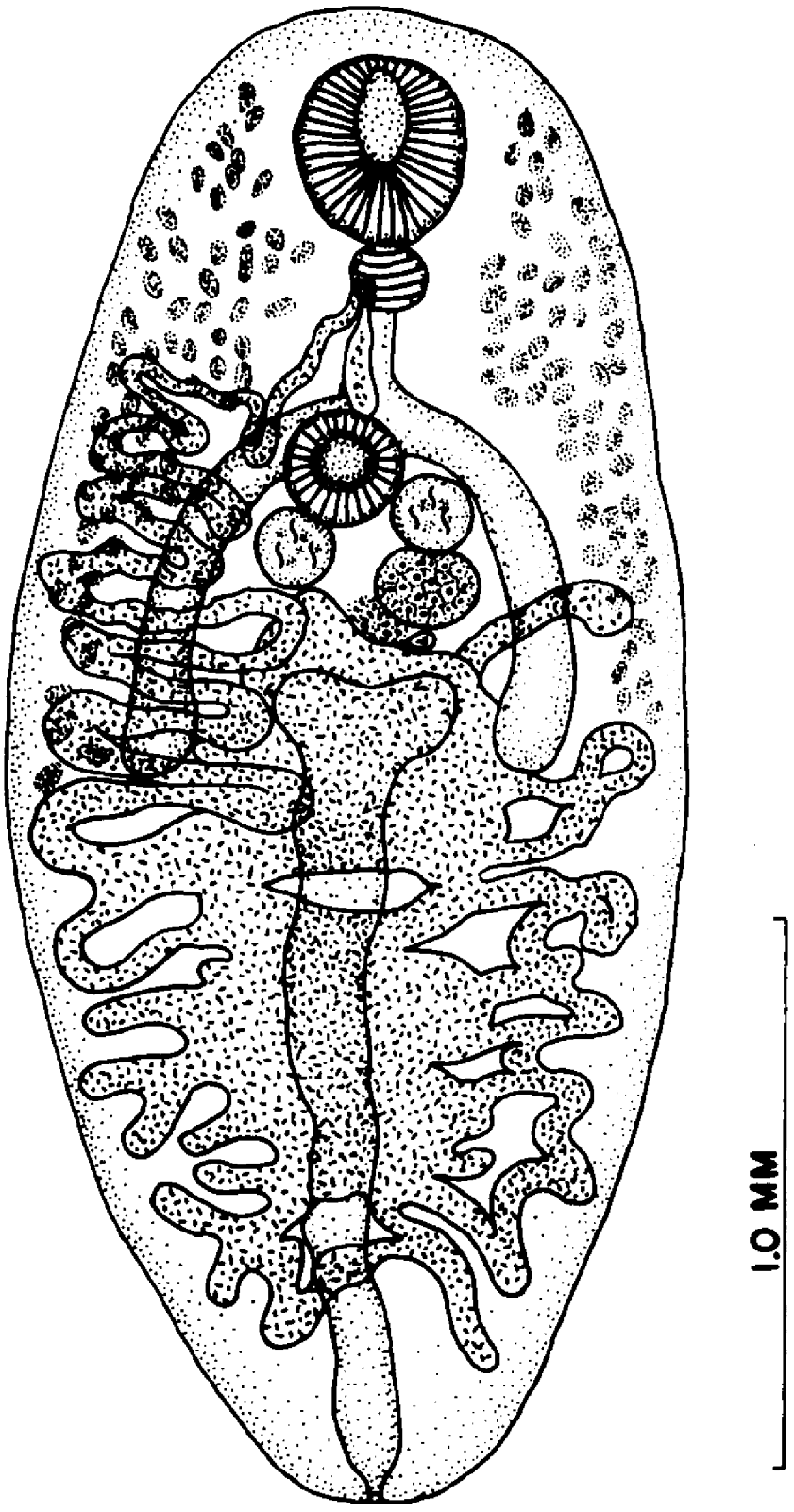
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PLATE X Dicrocoeliidae; Infidum similis Travassos, 1916

ventral view

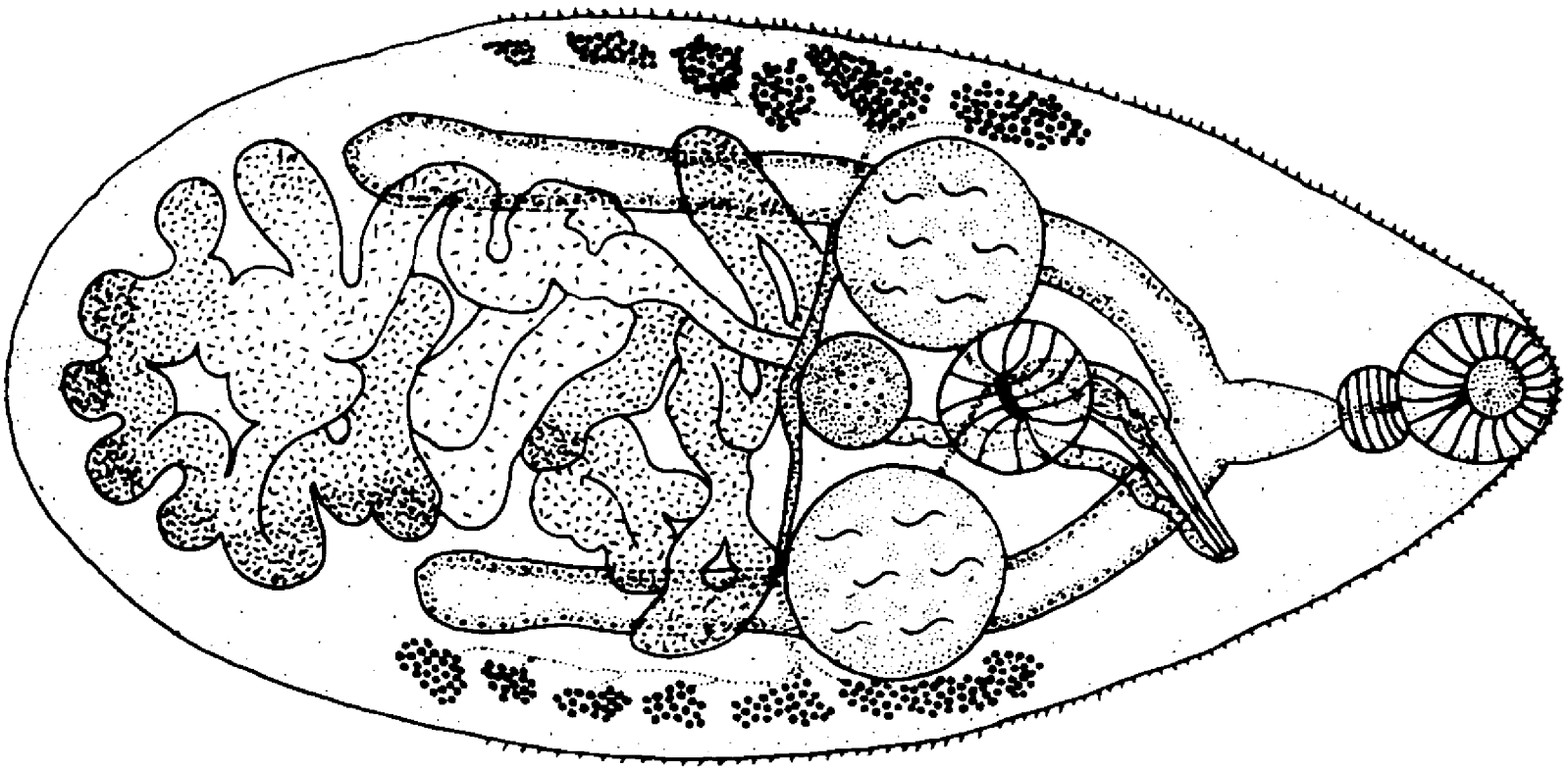
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PLATE XI Dicrocoeliidae; *Infidum similis* Travassos, 1916

intraspecific variation

Figure 1, from *Thamnophis sauritus*

Figure 2, from *Coniophanes bipunctatus*

Figure 3, from *Drymarchon corais*

Figure 4, from *Micrurus affinis*

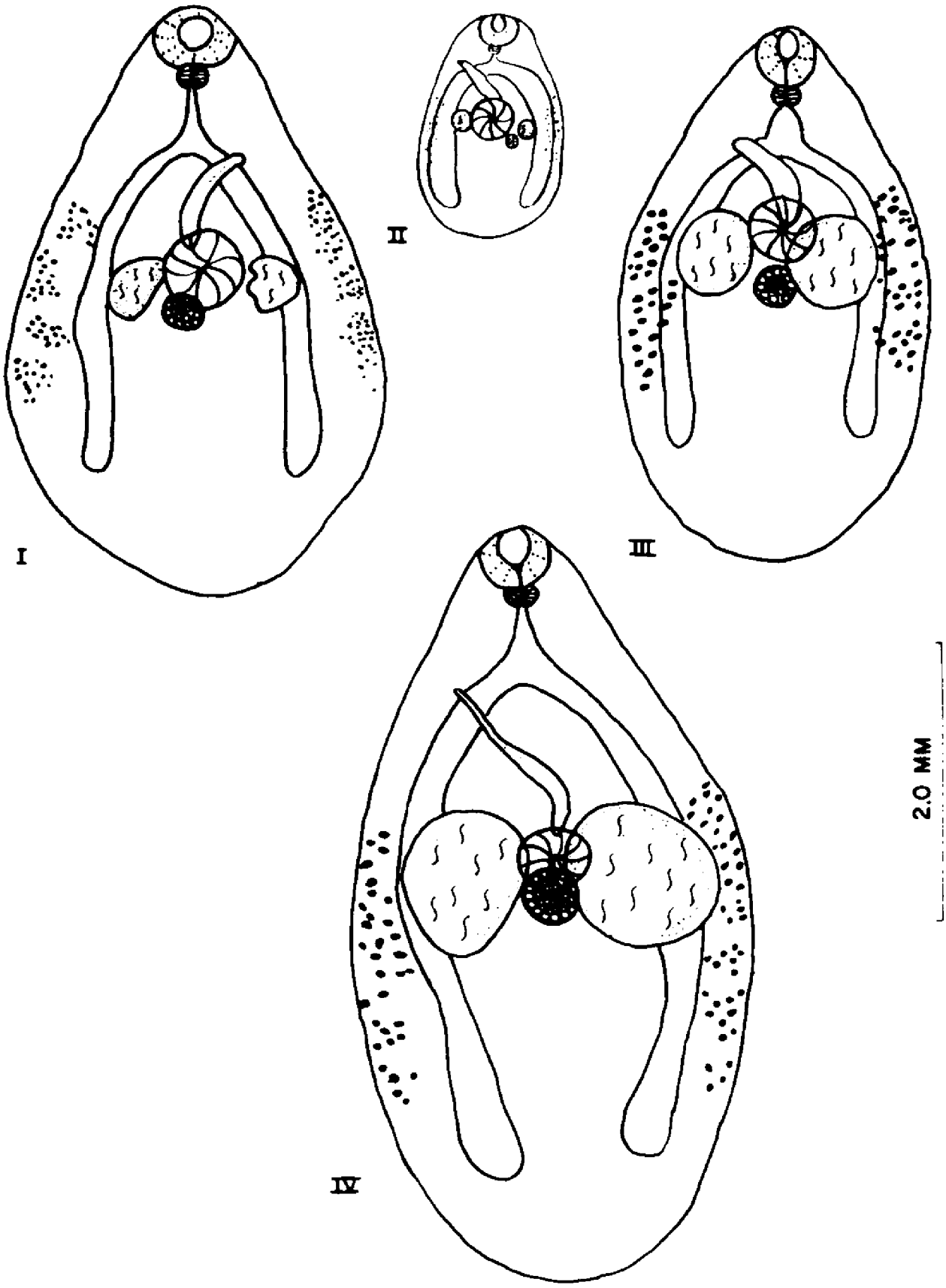
I
II
III
IV
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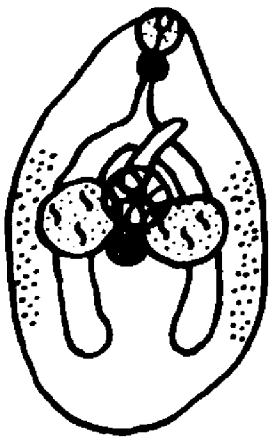
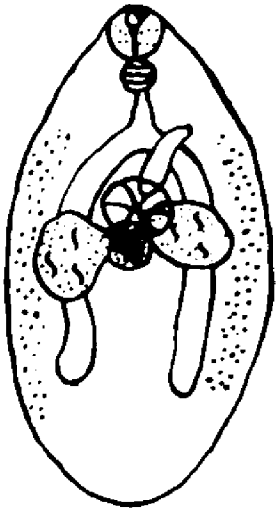
PLATE XII Dicrocoeliidae; *Infidum similis* Travassos, 1916

Figures 1-4 progressive growth forms from single infection in *Drymarchon corais*

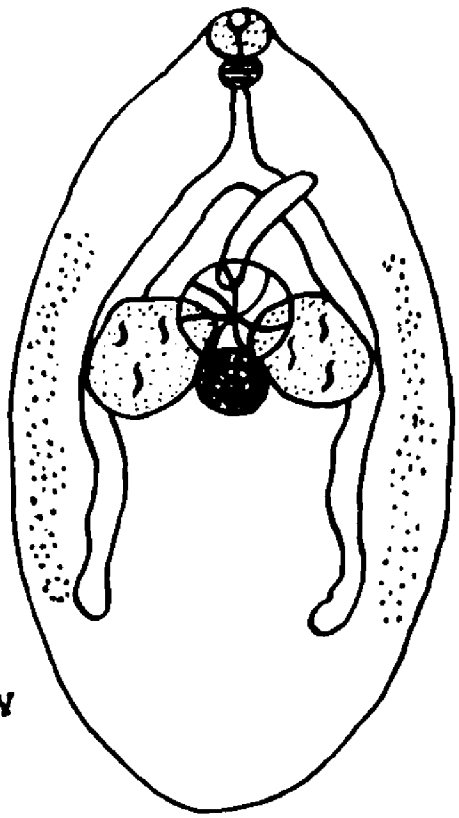
I



II



III



IV

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PLATE XIII Acanthostomidae; *Acanthostomum megacetabulum*

ventral view

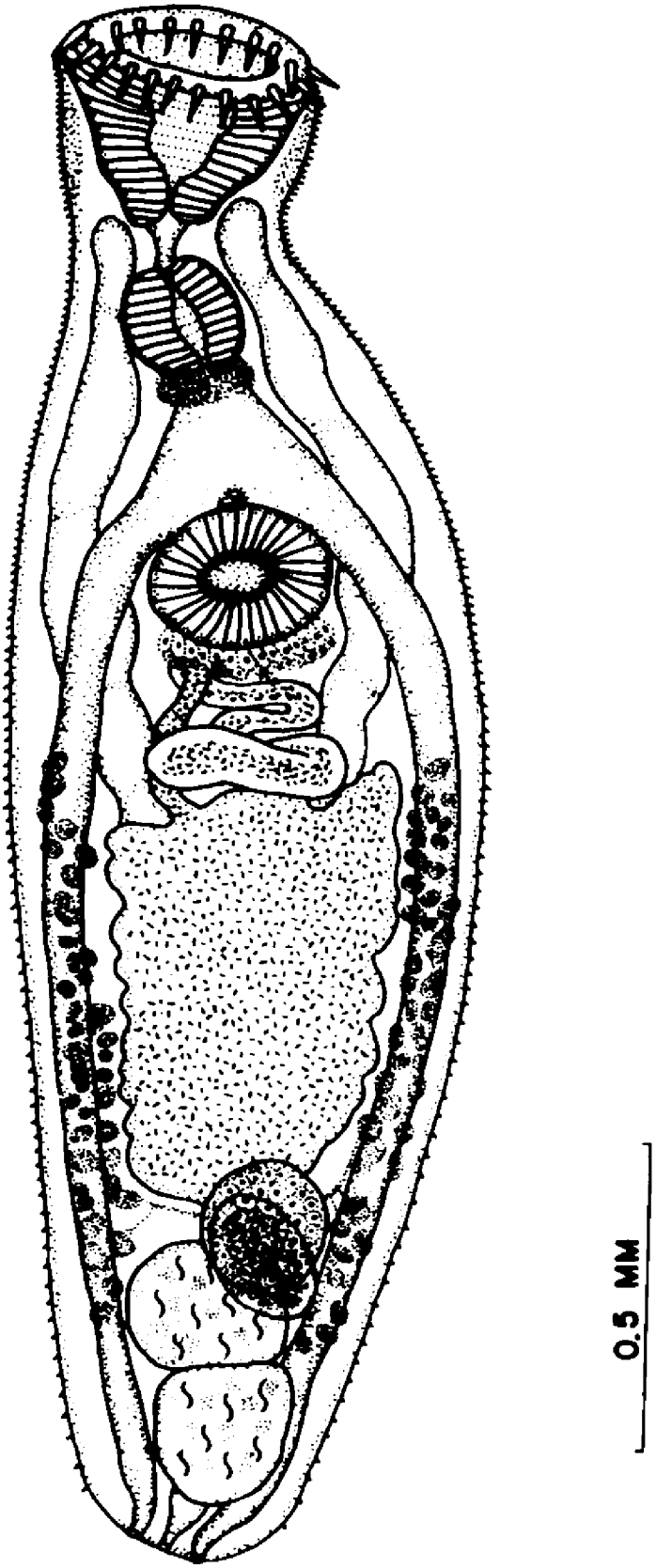
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PLATE XIV Acanthostomidae; Acanthostomum scyphocephalum (Braun, 1901) ventral view

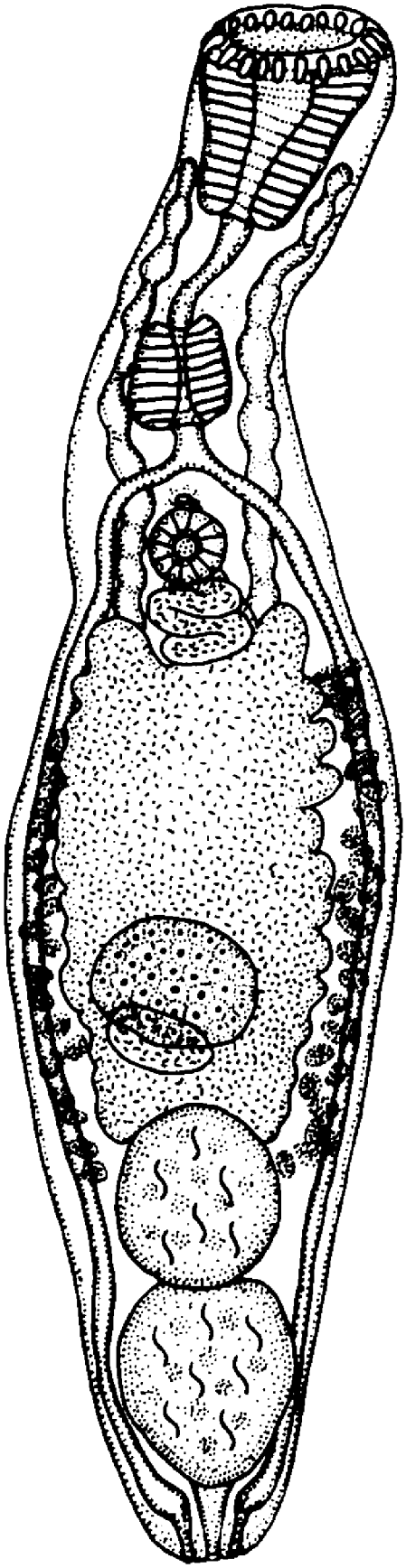
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PLATE XV Proterodiplostomidae; Proterodiplostomum ophidum

ventral view

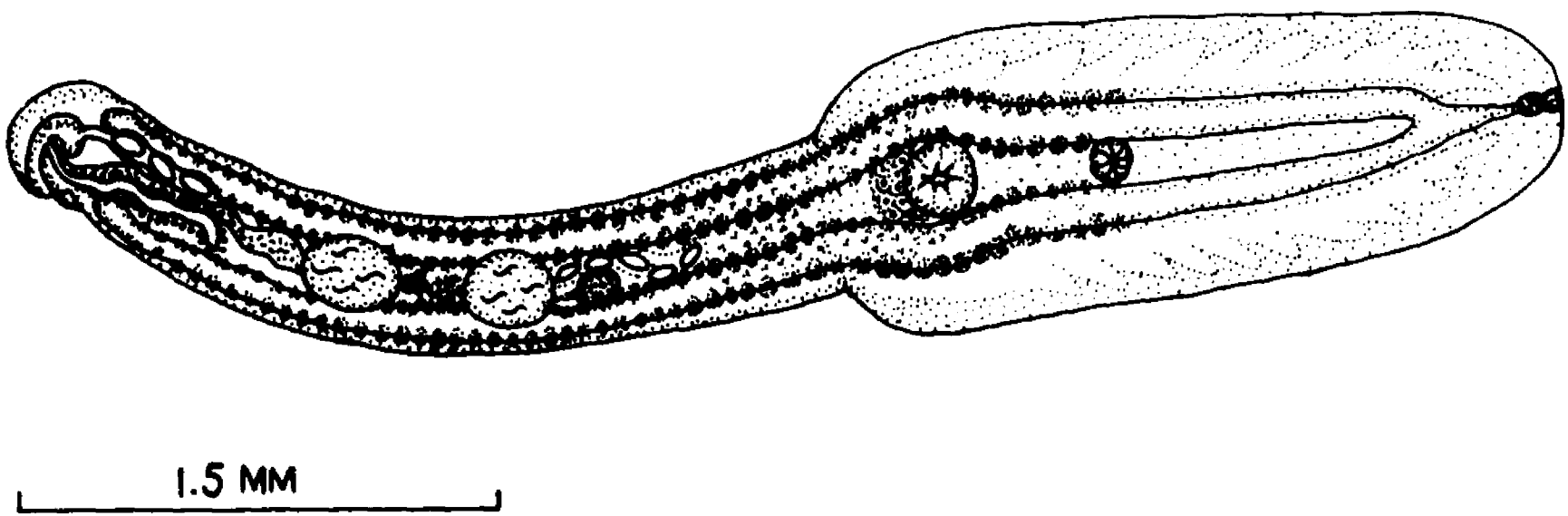
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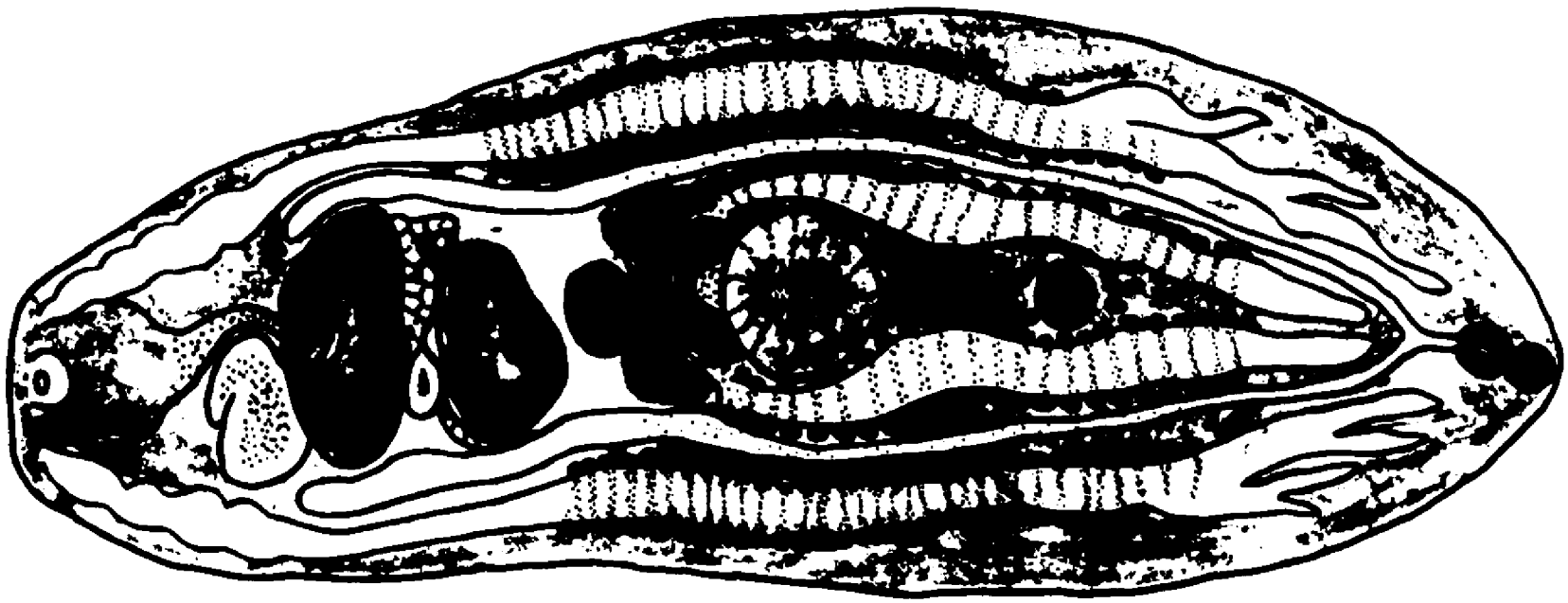
PLATE XVI Proterodiplostomidae; Herpetodiplostomum delillei Zerecero, 1947, ventral view



1.0 MM

PLATE XVII Proterodiplostomidae; Massoprostatum longum Caballero, 1947 ventral view

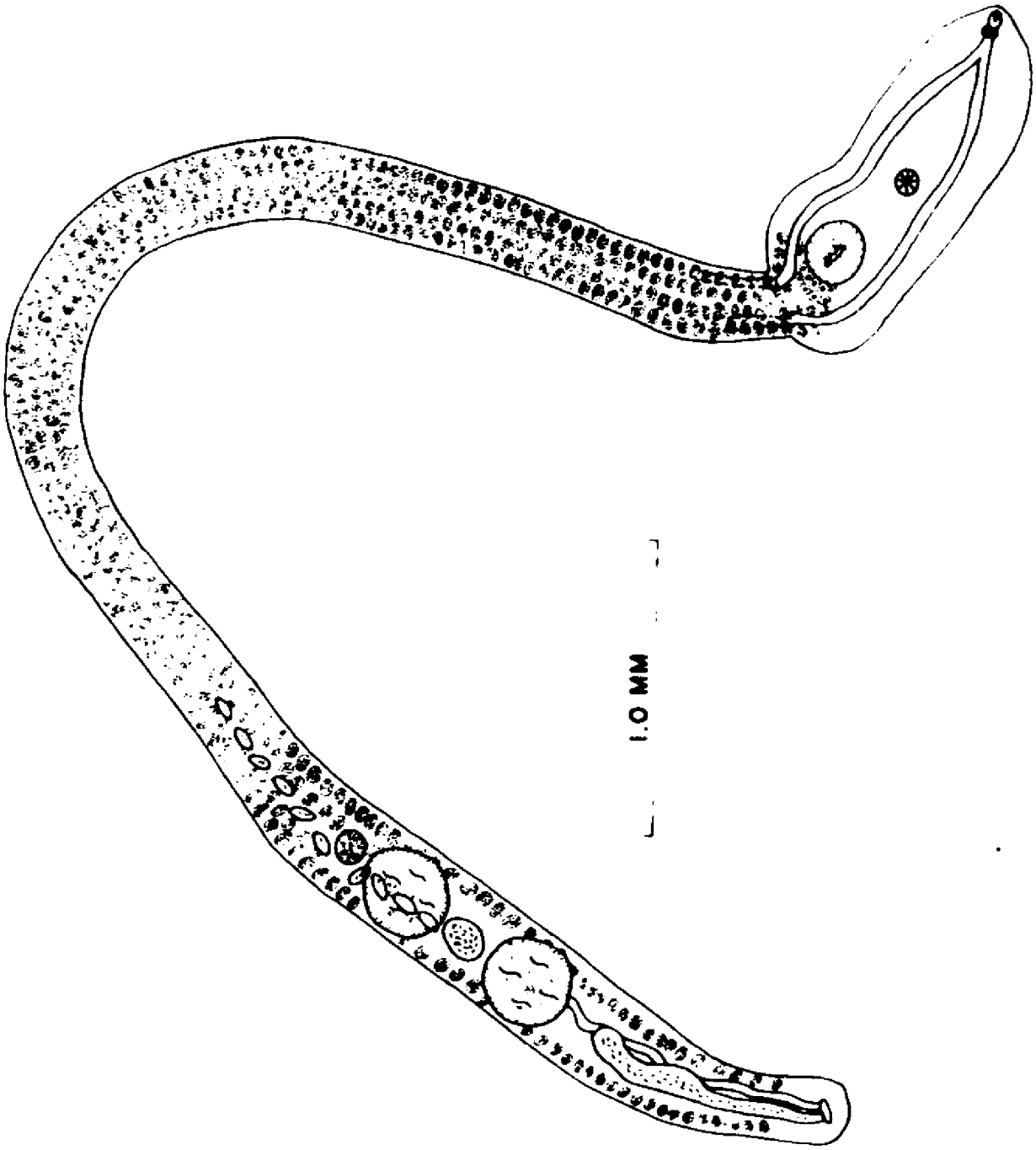

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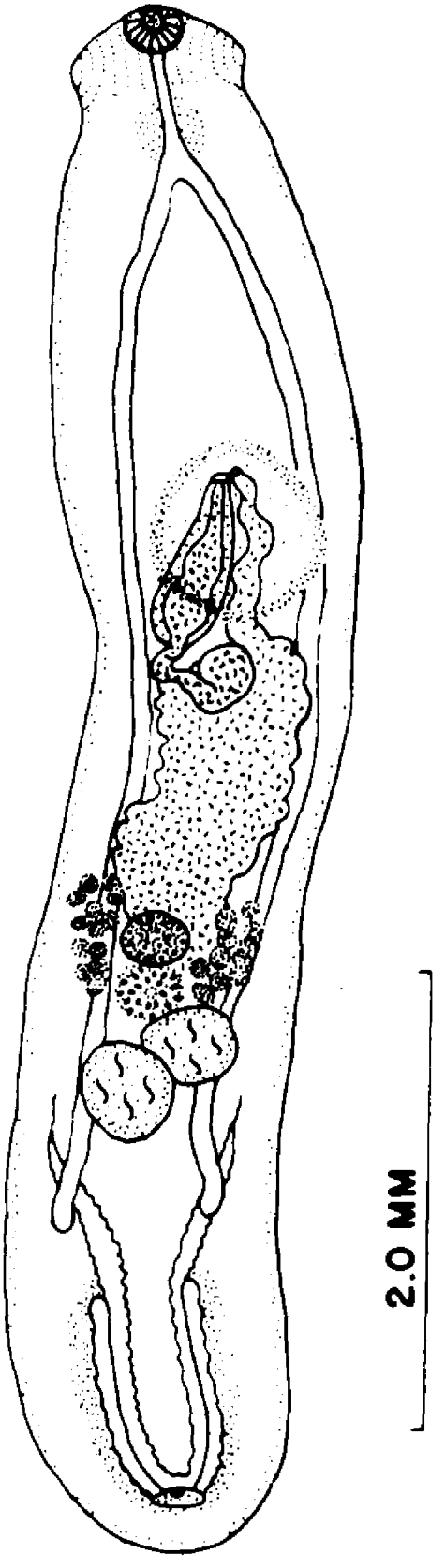
PLATE XVIII Pronocephalidae; Choanophorus rovirosai Caballero, 1942 ventral view


2.0 MM

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VITA

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EXAMINATION AND THESIS REPORT

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Major Field: Zoology

Title of Thesis: Systematic and Zoogeographic Studies on the Reptilian Trematode Fauna of Tabasco, Mexico

Approved:

Major Professor and Chairman

Dean of the Graduate School

EXAMINING COMMITTEE:

Date of Examination:

May 10, 1961